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# FLORA OF ADEN

BY

ETHELBERT BLATTER, S.J., F.L.S.

*Professor of Botany at St. Xavier's College,  
Bombay.*



CALCUTTA  
SUPERINTENDENT GOVERNMENT PRINTING, INDIA  
1914-1916



# RECORDS

OF THE

## BOTANICAL SURVEY OF INDIA

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*Published by order of the Government of India*

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### VOLUME VII

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SUPERINTENDENT GOVERNMENT PRINTING, INDIA  
1914

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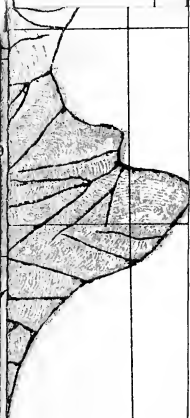
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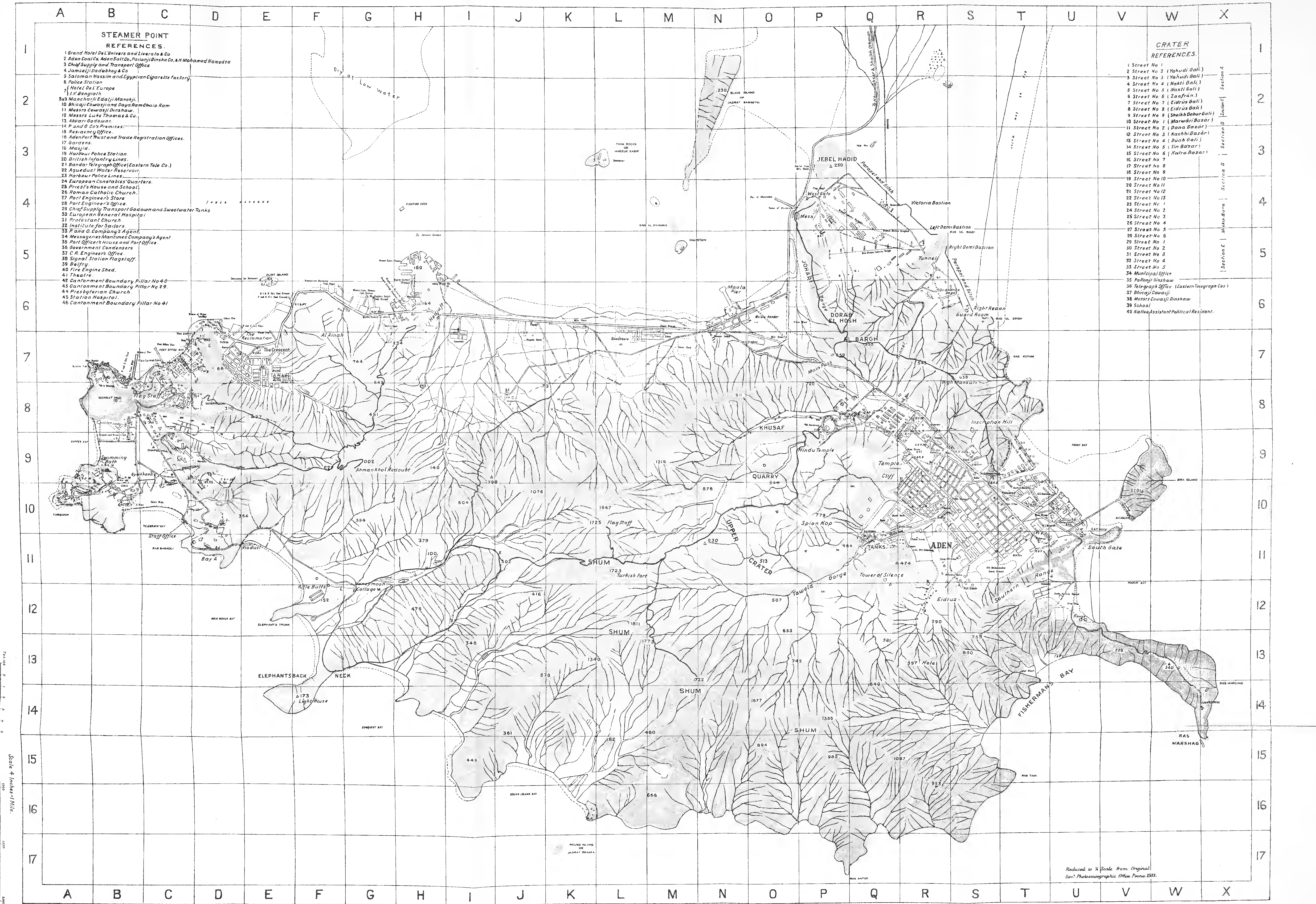
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## PREFACE.

It is now just a little over 50 years since Thomas Anderson published his "*Florula Adenensis*" describing 94 species. In 1905, K. Krause compiled a list of the plants reported from Aden in the past century, bringing the number of species up to 178. The catalogue of Aden plants which I wrote in 1907 mentions 196 species, and the present volume describes 250. Whilst revising and completing my former list by making use of the literature existing on the subject and examining the specimens preserved in various herbaria, I became aware of the great difficulties which lie in the way of identifying Arabian plants. This task requires not only a well-stocked library but also a considerable amount of leisure. Even then the endeavour is not an easy one, and would, in many cases, be unsuccessful, if good collections of African, Arabian, and Indian plants were not at one's disposal. Besides having in mind the scientific interest which attaches to the botanical knowledge of a country, it was chiefly with a view to facilitate the work of those who are interested in the vegetation of Aden, residents as well as travellers, that I decided to write this Flora.

Most of the plants have been examined either on the spot or in herbaria, and where this was not possible, a note will explain on whose authority a species has been included.

As to the description of orders, genera, and species, I made extensive use of the botanical works published on the neighbouring countries, not trying to change or add anything except in cases where good and well-preserved specimens gave a sufficient foundation for a more complete diagnosis. I did not wish to add to the confusion already existing in some publications.

In order not to create wrong notions with regard to the flowering and fruiting season I considered it advisable to indicate not only the month but also the year. If the latter were omitted a great number of plants would be shown flowering regularly throughout the whole year, whereas, as a matter of fact, this is the case in a few instances only.

Not too much reliance should be placed in the Arabic names. They were written down as they occur in various publications, spelt in the respective transcriptions of English, French and German botanists. Everybody knows what value may be ascribed to names taken down by travellers on the authority of some native guide who is anxious to oblige his employer.

I am greatly indebted to Dr. A. R. Rendle of the Department of Botany of the British Museum, and to Dr. O. Stapf of the Royal Botanic



Garden, Kew, for kindly allowing me the use of the collections and libraries. I was fortunate in finding in both establishments a staff ever ready to help me in my work.

To Mr. W. S. Millard, F.Z.S., I am much obliged for having placed at my disposal the collections of the Bombay Natural History Society.

Special thanks are due to Lieutenant-Colonel S. E. Prall, I.M.S., whose assistance in procuring information on many points of botany and meteorology has been of the greatest value. I wish to thank him especially for supplying the illustrations.

I owe a grateful tribute to Colonel F. W. Yerbury, R.A., for numerous notes and hints on the flora and fauna of Aden.

Finally, I wish to acknowledge the kind services rendered by Major A. T. Gage, I.M.S., Director of the Botanical Survey of India, Mr. E. G. Baker, F.L.S., Mr. J. Hutchinson, Mr. N. E. Brown, A.L.S., Mr. Spencer Le Marchant Moore, B.Sc., Professor Dr. E. Strasburger, the Rev. M. Gohier, S.J., Professor Dr. H. Fitting, Dr. Marie Hein, and Dr. C. von Marchesetti.



## I.—HISTORY OF THE BOTANICAL EXPLORATION OF ADEN.

Arabia is the least known country of Western Asia. Colonel Wahab who was engaged for some years in the delimitation of the boundary to the north of Aden has occupied himself with a very close examination of the possibilities that may occur for further exploration in that vast peninsula. His observations, though made with a view to geographical and archæological research, are equally applicable to the botanical exploration of the country. He says :—

“ Throughout Northern Arabia, that is, north of a line from Jidda, passing through Taif and across Nijd to Hofuf and the gulf, the peninsula has been crossed and re-crossed at intervals sufficiently close to enable us to form a fair idea of its general character. South of this line no trade or pilgrim route crosses it ; few Europeans have penetrated more than 100 miles in a direct line from the coast, and these have found their way barred by the sands of the Dahna. On the east and south coasts the strip between this desert and the sea has been explored first by the Indian Marine surveys and more recently by Zwemer in Oman and by Hirsch and Bent in Hadramaut ; on the west, Glaser and Halévy, both skilled archæologists, reached the western edge of the desert and explored the seats of ancient Sabaean and Minaean civilization in Marib and Nejrán. Omitting the half-million square miles of the Dahna desert as unprofitable waste, there still remain the northern districts of Yemen, the whole of the Asir highlands, and the hinterland extending north-east to the borders of Al Hasa as a field for the geographical explorer. A route from Saná northwards to Taif would lead through one of the most interesting districts of Arabia, of which nothing is known at first hand, except from the meagre accounts given by Tamisier and other French officers of Mehemet Ali's army between 1830 and 40.

“ The difficulties and risks of such a journey are serious. The whole Red Sea coast is Turkish, and British subjects have not, of late years, found travelling in Turkish possessions a safe or easy matter. The independent tribes in the interior of Arabia and northern Yemen are somewhat fanatical followers of the Imán, whose capital Sada lies in the direct road north from Saná. The British authorities would forbid any one entering from the Aden district. The only approach to this hinterland would therefore seem to be from the coast some distance to

the east of Aden, and thence ... an explorer with local experience might find his way to Marib and along the fringe of the desert to Nejrán.”<sup>1</sup>

Every botanist knows how scanty is our knowledge of the vegetation of Arabia in spite of the names of Léon Delaborde, Tayler, Rüppel, Forskal, Bové, Auchers, Boissier, Botta, Wellsted, Burlton, Schimper, Bormüller, Schweinfurth, Fischer, Anderson, Kotschy, Ascherson, Buhse, Deflers, Hirsch, Bent, Lunt, and others.<sup>2</sup> This is not surprising, however, if we consider on the one hand, the often insurmountable difficulties that lie in the way of every traveller in Arabia, and on the other the fact that even with regard to Aden it took more than a century before its flora was somewhat satisfactorily explored. In the following pages we wish to show the progress of our knowledge since the time when the first plant was collected at Aden.

**Henry Salt, 1809.**—When Salt<sup>3</sup> visited Aden in 1809, this place was in possession of Ahmed, the chief of the Azaibees. In 1802, Sir Home Popham had concluded a treaty of friendship and commerce with this chief. Whenever a favourable opportunity occurred, Salt seems to have collected plants, but, judging from his specimens in the British Museum, without appending any notes or records of stations to his plants. His specimens were named and enumerated by R. Brown in Appendix IV of Salt's "Voyage to Abyssinia," under the title: "List of New and Rare Plants collected in Abyssinia during the years 1805 and 1810, arranged according to the Linnean System."

There is only one specimen in his herbarium, a fragment of *Sterculia arabica*, of which we may say with some certainty that it must have been gathered at Aden. It is therefore, not on account of his collections that we mention Salt in this place, but owing to his botanical and other observations on Aden and the neighbouring country. These notes, though scanty, are not without interest, especially to European residents at Aden, because they date back to the beginning of the last century.

"On the 3rd of October in the morning we came in sight of the rugged mountains of Aden," says Salt, "and at two in the afternoon arrived abreast of the town. On our firing a gun, a boat came off with three fishermen, by whom we were advised to carry the vessel into

<sup>1</sup> Geogr. Journal, vol. 32 (1908) p. 564.

<sup>2</sup> For further details, *c.f.* Deflers A. Voyage au Yemen. Paris, 1889.

<sup>3</sup> Henry Salt, F.L.S., F.R.S., was born at Lichfield ca. 1785, and died between Cairo and Alexandria, 30th August, 1827. He was secretary and draughtsman to Lord Valentia in India and Africa from 1802-1805. After having travelled in Abyssinia in 1805 and 1810, he published his "Voyage to Abyssinia" in 1814. His plants were given to Banks and are now in the Herbarium of the British Museum. The Algae were sent to Dawson Turner ("Fuci" IV, 38). The genus "*Saltia* Brown" was called after his name. *Cf.*, J. J. Hall on the Life and Correspondence of Salt, 1854.

Back Bay, as the roads in front of the town were considered unsafe at this season of the year. Captain Weatherhead complied with this advice, and soon brought the ship to an anchor behind the rock, in an excellent situation, in four fathoms water with good holding ground.”<sup>1</sup>

“Aden, as a place of trade, is still of some consequence. It is the chief mart for the gums brought over by the Somali traders from the north-eastern districts of Africa, and coffee of the best quality may be procured in considerable quantities. The price of the principal articles at this time was as follows:—

Uddeen coffee . . .	70	dollars per bale of 305 lbs. nett.
Gum myrrh . . .	4½	dollars per frasil of 32 „ English
Gum aloes . . .	2	dollars per „ ditto
Gum Libanum . . .	1	dollar „ „ ditto
Gum mastich . . .	2	dollars „ „ ditto <sup>2</sup>

“Amongst the ruins some fine remains of ancient splendour are to be met with, but these only serve to cast a deeper shade over the devastation of the scene. The most remarkable of these reservoirs consists of a line of cisterns situated on the north-west side of the town, three of which are fully eighty feet wide and proportionately deep, all excavated out of the solid rock and lined with a thick coat of fine stucco, which externally bears a strong resemblance to marble. A broad aqueduct may still be traced which formerly conducted the water to these cisterns from a deep ravine in the mountain above; higher up is another, still entire, which at the time we visited it was partly filled with water. Some Arab children who followed us in our excursions were highly pleased when we arrived at the spot, and plunging headlong into the water much amused us with their sportive tricks. They ran about collecting flowers for us.”<sup>3</sup>

“On Friday the 6th, I resolved to ascend the mountain. The road is extremely steep and much incommoded by loose stones and pieces of rock, so that it was not long before our resolution was severely put to the test. After surmounting the first difficulty we came to a deep gully, in which we found two or three small pits of rainwater, some trees, and a few straggling goats. After traversing this gully another steep presented itself, that took us up to a ragged plain about a mile in extent, which, though at this time parched up, affords, after the rains, sustenance enough for a considerable number of goats.”<sup>4</sup>

<sup>1</sup> Salt, *Voyage to Abyssinia*, London, 1814, p. 99.

<sup>2</sup> Salt, l. c. p. 106.

<sup>3</sup> Salt, l. c. p. 107-108.

<sup>4</sup> Salt, l. c. p. 108.

The ship not being likely to complete her stock of water in less than three days, Salt determined to take the opportunity of making a journey to Lahej. "The first part of our road," he says, "conducted us round the bottom of Back Bay, near which stands a small building called "beit el mi," or the "water-house." About half a mile further, a causeway built on seven arches connects to the continent the "peninsula" of Aden. Directly north from this causeway runs an ancient aqueduct, the ruins of which may be clearly traced for about eight miles into the country.<sup>1</sup> At the end of the plain over which the aqueduct is conducted stands a tomb and a caravanserai dedicated to Sheik Othman.<sup>2</sup> About half a mile from the tomb we entered a deep wood of large and spreading trees, of a species of mimosa, called by the Arabs Sa-muk.<sup>3</sup> This wood extends about eight miles across, and is said to occupy two days' march in length, lying in an east and west direction. Numbers of goats and camels are seen in every quarter wandering about it, which, at this season of the year, are chiefly fed on the leaves and tender branches of this tree.

"The road leading out of the wood opens upon a barren plain covered with hillocks composed of a fine loose sand, which, constantly drifting from place to place, prevents the growth of a single blade of vegetation. The desolate scene, though only five miles across, conveyed to my mind a much stronger image of a 'desert that might be fatal to man and beast,' than any I had before passed. When we had crossed it, the return to the gradual appearance of verdure was peculiarly grateful to the eyes, and soon afterwards we reached a highly rich and cultivated track of land bordering on the town of Lahadj. Here we found wheat, juwarry and cotton flourishing with great luxuriance, the ground being intersected by artificial dykes, supplied with water by means of those simple machines common throughout Arabia and Egypt. The whole country, besides, was interspersed with date trees.<sup>4</sup>

"To the north of the town flourishes an extensive grove of date, mango, sycamore, and pomegranate trees, among which I observed several very lofty and fine trees, called by the Arabs bedan<sup>5</sup> ; the leaves of

<sup>1</sup> Salt, l. c. p. 112.

<sup>2</sup> Salt, l. c. p. 113.

<sup>3</sup> Salt's "Sa-muck" was probably *Acacia spirocarpa* Hochst.

<sup>4</sup> Salt, l. c. p. 114.

<sup>5</sup> I have not been able to find the word "bedan" in any Arabic dictionary ; but judging from Salt's description, which mentions the shape and arrangement of the leaves and the form and size of the fruit, there can scarcely be a doubt, that he meant *Terminalia Catappa* Linn. This tree is indigenous in the beach forests of the Andamans and the Malay Peninsula and a widely spread littoral species within the tropics. The word "bedan" is probably only a form of the Indian "badam," which means "almond." In India *Terminalia catappa* is called "jangli-badam," "hiudi-badam," "nat-vadam," "vedam."

these trees grow in clusters, and in shape are somewhat similar to those of the laurel, the fruit, in form and size, resembling an almond, and being not unpleasant, though very astringent to the taste. The quantity of water required for cultivation in this place is astonishing, the soil round the trees is obliged to be kept constantly moist, which, during the dry season, is entirely supplied by the assistance of art. This season, fortunately, does not last more than two months; during the remaining ten, occasional showers intervene, and in December, the rains on the adjacent mountains fall so heavily, that the river which passes Lahadj, though at times nearly dry, swells into a prodigious torrent.<sup>1</sup>

**M. P. Edgeworth, 1846.**—For about 30 years following Salt's visit to Aden the political situation of the country was not very favourable to the more peaceful pursuits of scientific research.

Ahmed's nephew and successor, Mohsin bin Fadhl, was an inhospitable, deceitful, avaricious, and unscrupulous man. In 1829, the Court of Directors of the East India Company planned a coaling station at Aden, but the idea had to be abandoned owing to the difficulty of obtaining labour. In 1833, Turkchee Bilmas made an attempt to gain possession of Aden. In reply to his demands his emissaries were slain. In 1836, the Fadhlis attacked and sacked the town. When shortly after an outrage was committed on the passengers and crew of a bungalow wrecked near Aden, the Government of Bombay despatched an expedition against the place, and in 1838, Captain Haines demanded and obtained reparation. The treacherous behaviour, however, of the Sultan's son led finally to the occupation of Aden by the British in January 1839. After this several futile attempts were made by the Sultan as well as by other neighbouring tribes, to attack and take Aden.<sup>2</sup>

It was about this time that Edgeworth<sup>3</sup> of the Bengal Civil Service arrived in Aden. He is well known by his valuable memoirs on

<sup>1</sup>Salt, l. c. p. 116-117.

<sup>2</sup>Hunter. An account of the British Settlement of Aden, London, 1877, p. 165—166.

<sup>3</sup>Michael Pakenham Edgeworth was born on the 24th May 1812. He entered the Charter House in 1823, whence he removed to Edinburgh in 1827. Here he studied oriental languages and acquired some knowledge of Botany under Professor Robert Graham. In 1831, he joined the Bengal Civil Service. He was appointed to Ambala and afterwards to Saharanpur. In 1842 he came home on leave and returned in 1846 to India. He was stationed at Banda until 1850, when he was chosen one of the five commissioners for the settlement of the Punjab, first at Multan, and afterwards at Jullundar, but his Indian career was finally cut short by sunstroke. He died suddenly in the Island of Eigg on the 30th July 1881. His chief publications were on the Botany of India in the 'Transactions' and 'Journal' of the Linnean Society.

cf. Proc. Linn. Soc. 1880-82, p. 63; Trimen's Journ. Bot. (1881), p. 288; Cat. Sc. Papers II, 444, VII, 594.

Indian Botany and his long-continued labours in the cause of that science in India.

"On my way back to India," he writes, "I touched at Aden in October 1846, and while the steamer was coaling, was able to make a short herborization in the little ravine behind the hotel and on the very bare rocky sides of a hill adjoining. As very little seems to be known regarding the flora of this terrestrial paradise, I think that the results of my two hours' stroll may prove not uninteresting, as there are some curious forms and new genera and species to be noted among the few flowers I collected. The soil in which I found them was gravelly and rocky, the rocks all of volcanic origin."<sup>1</sup>

The results of this limited botanical excursion were communicated to the Asiatic Society of Bengal in 1847. Of the 40 species he collected in that short period, no less than 11 were new to science.

Anderson gives a true appreciation of Edgeworth's paper when he says :—

"The insurmountable difficulties attending the identification of such obscure species as those composing the Aden flora, without having access to extensive libraries and herbaria, are shown by the alterations I have made in many of the specific names proposed by Mr. Edgeworth ; while at the same time his valuable suggestions and accurate descriptions prove his extensive knowledge of genera and species."<sup>2</sup>)

**J. R. Roth, 1847.**—J. R. Roth appears to have been in Aden in 1847. He read a paper on the "Peninsula of Aden" before the Royal Academy of Sciences at Munich<sup>3</sup> on the 15th January 1848. Hooker's Journal of Botany (1849), borrowed the following extract from Roth's description :

"The indigenous plants are, on account of the aridity of the ground and air, limited to a few of the desert. Cultivation is out of the question, for want of means of irrigation. The largest tree is *Sterculia urens* which occurs sparingly in the deep recesses on the western shore. *Poinciana elata* and *Acacia planifrons* appear, likewise, of considerable size, in bays of difficult access. Most of them are felled at an early age ; *Balsamodendron Opobalsamum*, *Euphorbia Triaculeata*, *Capparis*

<sup>1</sup> Edgeworth, M. P. A couple of hours' Herborization at Aden, Journ. As. Soc. Beng. Vol. 16, p. 1211.

<sup>2</sup> Anderson, T. Florula Adenensis, London, 1860, p. IV.

<sup>3</sup> Roth, J. R. Ueber die Halbinsel Aden. München Gelehr. Anz. XXVI (1848) col. 313-18 ; Münch. Bull. Akad. 1848, col. 137-142.

*carnosa*, *Cadaba glandulosa*, continue shrubby, covering beds of torrents, *Cassia lanceolata* and *angustifolia*, *Gynandropsis pentaphylla*, *Cleome angustifolia*, *Anastatica Hierochuntica*, *Psoralea bituminosa* *Indigofera spec.*, *Statice spec.*, are among the scanty, stunted vegetation, which is met with in more protected situations, affording some appearance of verdure during one half of the year. Corn and vegetable as well as fodder, have all to be imported, partly by sea, from the African coast, and partly, in times of peace, from the continent. The coast to the westward is less barren than Aden; here are seen groups of palms and of shrubs consisting probably of *Rhamnus Napeca*, and *Acacia planifrons*.<sup>1</sup>

We have not seen Roth's specimens (if he made a collection at all), but considering that his *Sterculia urens*, *Acacia planifrons*, *Euphorbia triaculeata*, *Capparis carnosa*, *Cassia lanceolata*, *Gynandropsis pentaphylla*, *Cleome angustifolia*, *Anastatica Hierochuntica*, and *Psoralea bituminosa* have never been noticed at Aden by any other botanist (and there were a good many of them between 1846 and 1860), we are inclined to think that the identification of the plants mentioned was done in a somewhat superficial way. It is for this reason, that we did not take notice of Roth's names when drawing up the list of Aden plants.

**J. D. Hooker, 1847.**—On his route to India in December 1847, J. D. Hooker remained two days in Aden, where he made an extensive collection of its plants. The 'Extracts' from his private letters<sup>2</sup> are so valuable that we shall reproduce below the passage relating to Aden *in extenso*.

For his second visit to Aden, see under 'T. Thomson.'

The plants are in Herb. Kew.

**E. Madden, 1850.** Lieutenant-Colonel Edward Madden<sup>3</sup>, of the Bengal Artillery, collected a few Aden plants in 1850. They were sent to Sir W. Hooker among his general collection and are now at Kew.

<sup>1</sup> "Notice on the Peninsula of Aden, by Dr. J. R. Roth." Hooker's Journ. Bot. I (1849), 218.

<sup>2</sup> "Extracts from the private letters of Dr. Hooker, written during a botanical mission to India." In Hooker's London Journ. of Botany, VII (1848), p. 307-314.

Sir J. D. Hooker died on the 10th December 1911 in his 95th year.

<sup>3</sup> Madden collected in Simla and Kumaon, published his 'Nepal Plants' in Trans. Bot. Soc. Edinb. V, 116. He died at Edinburgh in June 1856. For his life see Proc. Bot. Soc. Edinb. (1856) p. 45.

**T. Thomson, 1851, 1861, 1872.**—Thomas Thomson<sup>1</sup> after 10 years distinguished work in the service of the East India Company joined his friend J. D. Hooker in Darjeeling (1849) and spent 1850 in travelling with him in the Sikkim Forests, the Khasi Hills, Cachar and Chittagong. On their return to England they largely increased the number of specimens of Hooker's previous collection at Aden, and also added some species to the list. The plants are preserved at Kew.

In 1854, we find Thomson as Superintendent of the Botanic Garden in Calcutta. When, owing to ill-health, he returned to Europe in 1861, he once more made a small collection of plants at Aden. A third set of Aden plants, gathered by Thomson, dates from 1872.

**James Vaughan, 1852, 1853.**—Very little is known of the life and work of James Vaughan, M.R.C.S. He was Assistant Surgeon to the Bombay Army.<sup>2</sup> In 1852 we find him at Aden in the capacity of Civil and Port Surgeon.

In the same year he published his valuable "Notes upon the Drugs observed at Aden, Arabia."<sup>3</sup> Hooker's Journal of Botany says that the article "is full of important information, collected by a gentleman every way qualified for such an undertaking, during an official residence at Aden."

We give the following extracts from Vaughan's paper:—

"With some of these vegetable productions," he says, "the commercial and scientific world are already acquainted, with others they are

<sup>1</sup> T. Thomson, born in Glasgow on the 4th December 1817. On entering the medical classes at Glasgow he concentrated his attention on botany, under Sir William Jackson Hooker. After graduating M. D. in 1834 he entered the service of the East India Company as Assistant Surgeon. He was appointed to the Curatorship of the Museum of the Asiatic Society in Calcutta in 1840. In August of the same year he was sent to Afghanistan in charge of a party of European recruits. He was besieged in Ghuznee during the winter of 1841, and when the place fell in March 1842, he was made a prisoner, destined to be sold into slavery in Bokhara. But he succeeded in bribing his captor to convey him with some fellow-prisoners to the British army of relief. Later on he served through the Sutlej campaign and was afterwards stationed at Lahore and Ferozepur. During this period he was engaged in exploring the botany of the plains and the outer Himalaya ('Western Himalaya and Tibet,' London, 1852). Returned to England in very broken health in 1851, succeeded Falconer as Superintendent of the Botanical Garden in Calcutta in 1854. Retired in 1861 and returned to England in ill-health. Went again to India in 1871. Died in London on the 18th April 1878.

*Cf.* Journ. Bot. (1878), p. 160; 'Nature' vol. 18, p. 15; Proc. Geogr. Soc., vol. 22, p. 309; Gardener's Chronicle I, (1878), p. 529.

<sup>2</sup> Britten, J., and Boulger, G. S.: Biographical Index of British and Irish Botanists, London, 1893, p. 173.

<sup>3</sup> Vaughan, J.: Notes upon the Drugs observed at Aden (Arabia). In Pharm. Journ. XII (1852), 226—29, 268—71, (1853) 385—88.



less familiar, and of a few it may be presumed that they know scarcely anything. With regard to science and especially medicine, it is much to be regretted that some eminent Botanist does not turn his attention to this part of the world, where nature has been so lavish in her precious gifts, and where a wide field of research is open to him, from which he might make many important and original additions to the present stock of medical knowledge, and thereby establish a high claim to the esteem and gratitude, of his profession in particular, and of the scientific part of the community generally. Scarcely anything is known at present of Eastern Africa beyond the sea-board, and the same remark applies to Southern Arabia. With regard to the latter country in particular, famous even in the early ages of the world for its valuable vegetable produce, it appears almost unaccountable that this country should be well-nigh as little known to us as it was to the learned in the days of the ancient Greeks and Romans.”<sup>1</sup>

**R. L. Playfair, 1852—1862.**—Robert Lambert Playfair was connected with Aden from 1852 to 1862. Born at St. Andrews in 1828, he entered the Madras Artillery on the 12th January 1846. He was transferred to the Madras Staff corps in February 1861 and retired from the Army as Lieutenant-Colonel on the 1st November, 1867. After having been associated with Sir James Outram in a *quasi*-political mission to Syria, he served as Assistant Executive Engineer at Aden from March 1852 till September 1853. When Outram became first Political Resident, he chose Playfair as his assistant. In this capacity Playfair remained at Aden from July 1854 till 17th December 1862, during which time he acted twice as temporary Political Resident.<sup>2</sup>

Playfair found time to make extensive researches into the history of Yemen. The results were published in Bombay in 1859 as No. 49 of the new series of “Selections from the Records of the Bombay Government” under the title: “History of Arabia Felix or Yemen from the Commencement of the Christian Era to the Present Time.” It included also an account of the British settlement at Aden.

In spite of his numerous avocations as Assistant Political Resident and his serious pursuits in historical research, he found time to take a lively interest in botany. He sent a number of plants to Kew, and

<sup>1</sup> Hooker: Journ. Bot., Vol. V, p. 124.

<sup>2</sup> After this Playfair was appointed in succession Political Agent at Zanzibar (1862), consul in the same place (1863), Consul-General in Algeria (1867), Consul-General for Algeria and Tunis (1885), Consul-General for the territory of Algeria and the northern coast of Africa (1889). He retired from the diplomatic service in December 1896 and died at St. Andrews on the 18th February 1899. He published “Reminiscences” of Aden and Algeria in Chamber’s Journal.

several species were accompanied by coloured sketches which he had personally made from living specimens. Brandis mentions that Playfair cultivated with great care a number of the more interesting Aden plants in the little garden surrounding his bungalow.<sup>1</sup> It was also owing to his exertions that Dr. G. Birdwood was finally enabled to give a description of the Frankincense tree, *Boswellia Carterii*.

**D. Brandis, 1855.**—When Dietrich Brandis<sup>2</sup> went to India for the first time in December 1855, he stopped for a day at Aden and collected 46 plants. He is the only visitor we came across, who spoke of the “wonderful variety of the vegetation of Aden” (wunderbarer Pflanzenreichtum). He gave the number of plants growing at Aden as amounting to about 260, and in this he came nearer the truth than any other botanist. A short sketch of his voyage appeared in “Petermann’s Mitteilungen,” from which we give the following extracts relating to the flora of Aden:

“We went to the next valley where I had a very rich harvest, below as well as on the slopes. The most wonderful forms, not only of well known orders and genera but also quite new plants, which cannot be named without closer examination, grow out of the bare rubble, mostly in flower and fruit. Nowhere a trace of water; there is, indeed, only one well in the whole peninsula. It is only the luxuriant green of the Arabic *Reseda* and of the spiny *Capraris* in full bloom, which point to the presence of dew and moisture in the air. After my return from that valley so rich in plants I mounted a donkey and rode along the sea towards the town of Aden. Every step revealed new treasures; to the right of the road there was a splendid golden yellow *Cleome* with delicate foliage and covered with flowers, here and there one of those green *Euphorbia*-trees, spiny like several species of this protean genus in Greece, and between them the quaintest of annual weeds; in short, I collected not less than 46 flowering plants in the course of three or four hours. The whole of Aden produces about 260 known species, all belonging to the phanerogams. Whilst the neighbouring mountainous country of Arabia Felix has almost regular rainy seasons and is, for this reason, a fit place for mosses and ferns, we find that the peninsula of Aden receives some rain only every 18 months on the average.”<sup>3</sup>

<sup>1</sup> Petermann’s Mitteilungen (1857), p. 480.

<sup>2</sup> Dietrich Brandis was born in Bonn on the 31st March 1824. He studied at the Universities of Copenhagen, Göttingen, and Bonn. In 1856 he was appointed Superintendent of Forests in Pegu; was Inspector General of Indian Forests from 1864-83; was knighted in 1887. He was one of the most eminent writers on Indian botany. Died in 1907.

Cf. Proc. Linn. Soc. (1907-08), p. 46; Journ. Bot. (1907), p. 288; Gard. Chronicle (1907) I, 376; Indian Forester, 1907.

<sup>3</sup> Petermann’s Mitteilungen (1857), p. 480.

Brandis speaks of a certain "Mrs. Sp. who," he says, "is not an amateur only but a perfect and well trained botanist, who is said to own the best microscope which, up to now, has been constructed in England." We regret not having been able to ascertain the name of that accomplished lady, because, in all probability, some of her collections must still be preserved in a museum or private herbarium of England.<sup>1</sup>

**R. H. Schomburgk, 1857 (?)**.—There are a few Aden plants at Kew collected by Sir Robert Hermann Schomburgk.<sup>2</sup> We do not know the exact date of his visit to Aden. It must have been before 1860, as Anderson made use of his specimens for the publication of his "Florula." It was probably in 1857 when Schomburgk was appointed British representative to the Siamese court.

**T. Anderson, 1859.**—Thomas Anderson<sup>3</sup> was the first to give a systematic description of the flora of Aden. Belonging to the Bengal medical service he was actively engaged during the Mutiny. In 1858 we find him in Calcutta, but, his health failing, he was obliged to go home. "While detained at Aden," he writes, "on my return from India in May 1859, I was enabled to make two short excursions nearly to the centre of the peninsula, and, considering the limited character of the flora, I secured an extensive set of specimens of nearly all its species. I was so fortunate as to find most in a good state for identification; the

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<sup>1</sup> *Note*.—It seems that the plants collected by Brandis exist no longer. Professor Strasburger kindly informed me that they are not at Bonn, but he suggested that they might be in Hamburg, as the 'Botanische Staatsinstitute' of that town had acquired Brandis's herbarium. Professor Fitting, the Director of the Botanical Institutes of Hamburg tells me, that there are no plants from Aden in the Hamburg Herbarium. It is, therefore, probable that the plants which Brandis gathered at Aden, perished in the same fire, which destroyed his early collections.

<sup>2</sup> Schomburgk was born at Freiburg in Prussian Saxony, June 5th, 1804, and died 11th March 1865 at Schöneberg near Berlin.

<sup>3</sup> T. Anderson was born in Edinburgh in 1832. He graduated as M. D. in the same town in 1853. In the following year he entered the Bengal Medical Service, and went to Calcutta. Subsequently he went to Delhi, where he was engaged during the Mutiny. After his return to England in 1859, he published his *Florula* in 1860. He returned to India and took temporary charge of the Calcutta Botanic Gardens, during the absence of Dr. T. Thomson. He succeeded him afterwards as Director. In this capacity he did much to improve the Gardens, by introducing valuable medicinal plants, especially *Cinchona* and *Ipecacuanha*. From 1864-1866 he undertook to organise and superintend the Forest Department in Bengal. Serious illness forced him in 1868 to return to Europe. He recovered and devoted himself to working out the *Flora Indica*. He paid special attention to the *Acanthaceæ*, but before he was able to complete his work, he died at Edinburgh on the 26th October 1870.

*Cf.* Journ. Bot. (1870), p. 368; Gard. Chronicle (1870), p. 1478; Trans. Bot. Soc. Ed., Vol. 11 (1875), p. 41; Proc. Linn. Soc. (1870-71), p. lxxx.

result of a copious fall of rain which had occurred about three weeks before my visit, and which had brought most of the plants into flower and imparted a slight tint of green to many of the least sterile valleys.”<sup>1</sup>

In 1860 Anderson published his *Florula Adenensis* from the materials collected by Edgeworth, J. D. Hooker, Thomson, Madden, Schomburgk and himself. He enumerated and described 94 species and amongst these 11 for the first time. It becomes quite evident from a perusal of his *Florula* that he spoke the full truth when he wrote: “Most of the plants have required a careful comparison with a large suite of specimens from various localities, and the consultation of a formidable array of works on Indian and Arabian botany, in order to determine their synonymy and geographical distribution.”<sup>2</sup>

It is interesting to hear him relate how he got up the synonymy of *Fagonia cretica*, Linn. He says: “I have devoted several days on two occasions to the examination of a most extensive suite of authentic specimens of the many described species of this genus, and both times I arrived at the same conclusion—that there is but one species. The Kew Herbarium contains about 400 specimens of *Fagonia*; and these I attempted to divide into De Candolle’s two sections, of leaves simple and leaves trifoliate. The result of this first apportioning was, that the one-leaved section contained only ten specimens, while 390 remained in the section with trifoliate leaves. The ten simple-leaved specimens belonged to the following species: 2 of *F. cretica*, Linn.; 1 of *F. Oliveri*, DC.; 2 of *F. Myriacantha*, Boiss.; 1 of *F. parviflora*, Boiss., and 4 of *F. subinermis*, Boiss. The remaining 390 specimens, all of which were more or less trifoliate, included all the described species of *Fagonia*. The next step was the selection from the 390 specimens of all the individuals in which trifoliate leaves alone occurred. These amounted to 123 specimens, leaving 267 as intermediate with the simple-leaved and trifoliate sections.”<sup>3</sup> In this way he continued till, finally, he came to the conclusion, that all the described species ought to be considered as varieties of one variable species. This is only one typical case, but it is sufficient to show, how conscientious and painstaking Anderson was in the composition of his book.

On the other hand his labours have been greatly lightened by daily reference to William Hooker’s unrivalled herbarium and rich library.

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<sup>1</sup> T. Anderson, *Florula Adenensis*. A systematic account, with descriptions of the flowering plants hitherto found at Aden. Journ. of Proc. Linn. Soc. Vol. V. (1860), Suppl., p. iv.

<sup>2</sup> Anderson, l. c. p. v.

<sup>3</sup> Anderson, l. c. p. 12.

"Without repeated examinations of the East Indian Herbarium and of the Arabian, Abyssinian, and Egyptian collections of Sieber, Delile, Aucher-Eloy, Schimper, and other travellers, in all of which the Kew Herbarium is peculiarly rich, the work could not have been accomplished."

Before proceeding to the purely descriptive part of his paper, Anderson found it desirable to notice the physical aspect and climate of Aden and to point out a few of the peculiarities of its flora. He then stated some facts with regard to the geographical distribution of the species and, finally, instituted a comparison of the Aden flora with those of Hong-Kong, Ischia, and Gibraltar. His general observations on the flora of Aden and especially on its relations to the vegetation of other parts of the old world, were certainly excellent at the time when they were published; but the more accurate botanical knowledge of the flora of Aden and the countries in question have, in several cases, superseded Anderson's views.

It is to be regretted that the notes as to the locality of the single species are generally very vague and that Anderson too often contented himself with the statement that the plant was found at Aden. Besides, flowering and fruiting seasons are never mentioned. We do not wish to blame him for these omissions, for in this he was only following the custom generally adopted amongst the botanists of his time. What Hooker and Thomson complained of, when publishing the first volume of their *Flora Indica*, was only too true: "We have long deplored the defective geographical nomenclature adopted in almost every work treating of the Natural History of India, and the fact that 'E Ind.' or 'Ind. Or.' is considered in most cases sufficiently definite information as to the native place of any production found between Ceylon and Tibet, or Cabul and Singapore."<sup>1</sup> We must, however, not forget that ecological and biological problems were still in their infancy 50 years ago.

Krause mentions the fact that a few plants, enumerated by Anderson, have never since been observed at Aden, in spite of the circumstance that travellers of a later date, notably Deflers, were especially anxious to find them again. As an explanation Krause suggests the possibility that Anderson, considering the little definite notes on the locality of the plants, included in his *Florula* various plants which had not been collected on the peninsula itself, but in the more distant neighbourhood of Aden.<sup>2</sup> We cannot accept this solution. The "locality" noted on the sheets of the Herbarium at Kew are in many cases more accurate than that given in the *Florula*, and does not allow any ambiguity. We

<sup>1</sup> Hooker, J. D. and Thomson, T.: *Flora Indica*. Introductory Essay (1855), p. 2.

<sup>2</sup> Krause, K.: *Beiträge zur Kenntnis der Flora von Aden*. 1905, p. 7.

know, besides, that none of the collectors whose plants formed the materials of Anderson's description, ever went beyond the isthmus which connects the peninsula with the continent.

**Alfred Courbon 1859-1860.**—Dr. A. Courbon accompanied the French exploring expedition to the Red Sea under the command of Captain Russel in the year 1859-60. Russel afforded the young scientist every facility in his power towards the exploration of the flora, and Courbon was able to collect, within a few months, 800 species in Abyssinia and on the coasts and islands of the Red Sea. At Aden he gathered 35 species, amongst them the South African *Kissenia spathulata* R. Br., which had not been reported from that locality by earlier botanists.<sup>1</sup> The botanical results of this expedition were published by Brogniart.<sup>2</sup>

The specimens were presented to the "Museum d'histoire naturelle" of Paris.

**Wichura, 1860.**—According to Krause, Wichura collected some plants at Aden in 1860, when accompanying the Prussian expedition to Eastern Asia. His specimens are in the Herbarium of Berlin.<sup>3</sup>

**Oliver and Cleave, 1863.**—There are a number of specimens in the Kew Herbarium, which were collected at Aden by "Oliver and Cleave" in January 1863. In spite of prolonged investigation we have not been able to gather any information regarding the bearers of these names.

**Zenker, 1868.**—All we know is that a certain Dr. Zenker collected a few plants at Aden in 1868. The specimens are preserved in the Herbarium of Berlin.<sup>4</sup>

**J. M. Hildebrandt, 1872, 1873, 1875.**—Hildebrandt visited Aden in June 1872, before starting on his journey to Somaliland, and apparently, a second and third time in May 1873, and March 1875. According to Krause the plants collected by Hildebrandt belong to the Botanical Museum of Berlin. A set of duplicates is in the Herbarium of Kew, but, judging from the numerous references to Hildebrandt's specimens in Krause's "Beiträge," it seems to be far from being complete. Hildebrandt's plants were described by Vatke in the "Oesterr. Bot. Zeitschr." and in "Linnæa."<sup>5</sup>

<sup>1</sup> Anderson : Florula Adenensis, p. 42.

<sup>2</sup> Brogniart, A. : Notice sur les résultats relatifs à la botanique obtenus par le docteur Alfred Courbon, pendant le cours d'une exploration de la mer rouge exécutée en 1859-60. In Bull. Soc. Bot. de France, VII, 898-903.

Courbon seems to have published a book under the title : "Exploration de la mer rouge sous les ordres de Mr. Russel Capitaine de Vaisseau, 1859-60." The book is not known to us.

<sup>3</sup> Krause l. c. p., 8.

<sup>4</sup> Krause l. c. p., 8.

<sup>5</sup> Oesterr. Bot. Z. Vol. XXV—XXX; Linnæa, Vol. XLIII. For details, *vide* bibliography.

**C. von Marchesetti, 1875, 1880, 1881.**—Von Marchesetti at present Director of the Natural History Museum and Botanical Gardens at Trieste, visited Aden for the first time in October 1875. When botanizing on the Shum Shum Range he found several plants which had not been noticed before in that place, but, at the same time, exposure to the tropical sun proved almost fatal to him.

We do not know in which year Von Marchesetti was a second time at Aden. All we could ascertain is that, according to his own statement, he collected on this and the former occasion more than three-fourths of all the species known from that locality.

In October 1880 the Austrian Lloyd opened a new line to Hongkong and Von Marchesetti accompanied the first steamer as Medical Officer. On his arrival at Aden (18th October) he gathered about 60 specimens. From Bombay he sent a description of his excursion to the "*Oesterreichische Botanische Zeitschrift*"<sup>1</sup> giving a short characterization of the country and some interesting notes on the general aspect of the flora.

Von Marchesetti proceeded on his tour, but did not reach China. He had a second attack of sunstroke in the Island of Pulo Penang and was obliged to return to Europe in February 1881. In spite of his weakened condition he disembarked at Aden in order to visit a small valley which was well known to him for harbouring certain interesting plants. Provided with a lantern and helped by a splendid moon, it did not take him long to find what he wanted. But his nightly expedition amongst the rocks in the immediate vicinity of the fortifications roused the suspicions of a sentry and von Marchesetti was arrested as a Russian spy. It was only with great difficulty and after many explanations that he at last succeeded in being set at liberty.<sup>2</sup>

**Annesley, 1875.**—A few plants were collected by Captain Annesley in 1875. His specimens are at Kew.

**O. Kuntze, 1876.**—Kuntze came to Aden on the 9th January 1876, towards the end of his scientific tour round the world. He stopped there only for three hours and collected 29 specimens of phanerogamic plants<sup>3</sup> which, later on, he embodied in his "*Revisio Generum Plantarum*."

Duplicates of his Aden plants have been acquired by Kew and the British Museum.

**J. Collins, 1877.**—There is a note in the Proceedings of the Linnean Society<sup>4</sup> saying: "Dr. Trimen, F. L. S., exhibited specimens of the *Oliba-*

<sup>1</sup> Marchesetti, C. Von, Ein Ausflug nach Aden, Oesterr. Bot. Zeitschr. (881) No. 1.

<sup>2</sup> Oesterr. Bot. Zeitschr. Vol. 33 (1883), p. 1-8 (Life and work of Von Marchesetti).

<sup>3</sup> Kuntze, Otto, Um die Erde. Reiseberichte eines Naturforschers, 2nd ed. Leipzig, 1888, p. 487.

<sup>4</sup> Proc. Linn. Soc. (1876-77), p. XXIV.

*num*, or Frankincense-tree, *Boswellia Carteri*, Birdwood, gathered by Mr. James Collins at Aden in October 1877."

**W. Wykeham Perry, 1878.**—Fleet-Paymaster William Wykeham Perry, R. N., though not a professional botanist, has done valuable work by his accurate observations and untiring efforts in collecting plants wherever his service called him. When he was stationed in the Red Sea, he collected a considerable number of plants at Aden during the months of March, April, May, June, and July of 1878. The numerous notes which accompanied his specimens show distinctly that he was more than a mere collector. With the assistance of Captain Hunter he obtained specimens of the Myrrh and *Olibanum* trees of Somaliland. He was also the first to bring to Europe living specimens of the plant yielding Socotrine aloes, which proving new to science was named in his honour *Aloe Perryi* Baker. He further succeeded in procuring a specimen of the Dragon's Blood tree of Socotra, which yields the drug called cinnabar by Dioscorides. It has since been described under the name of *Dracaena cinnabari*. Independently of these important acquisitions, Perry collected on the Somali coast, in the Persian Gulf, in Sind, Madagascar, Johanna Island, Corea, Manchuria, Formosa and on the coast of China. All these collections were transmitted to Kew.<sup>1</sup>

**J. B. Balfour, 1880.**—Balfour visited Aden in January 1880, when on his way to Socotra. He collected a considerable number of plants of which there is a set of duplicates at Kew.

Numerous references to the flora of Aden are to be found in his "Botany of Socotra."<sup>2</sup>

**F. M. Hunter, 1880.**—The author of the "Aden Handbook" and of "An account of the British Settlement of Aden" had a wide range of interests. At the end of May and beginning of June he gathered about 250 specimens of plants in the "neighbourhood of Aden." In a

<sup>1</sup> From the Kew Bulletin (1894), p. 397-398.

For those who knew Perry personally we insert the short biographical note contained in the same Journal, l. c. "This officer, whose services to Kew deserve some record, died on the 14th of June, 1844, at the early age of 48, a fact that only recently came to our knowledge. Mr. Perry distinguished himself 19 years ago by an act of gallant courage. When Commodore Goodenough was fatally wounded in the Pacific by what was believed to be a poisoned arrow, Mr. Perry, although suffering from a sore mouth, devotedly sucked the wound, unhappily without avail. In 1873, with the co-operation of Commodore Goodenough he obtained a specimen of the only kind of tree that inhabits the remote Amsterdam Island in the South Indian Ocean. The existence of trees on the island had been observed eighty years previously, but not until Mr Perry sent a specimen to Kew was it known to be the same (*Phylica arborea*) as that inhabiting the 5,000 miles-distant Tristan d'Acunha group."

<sup>2</sup> Balfour, J. B. Botany of Socotra. Edinburgh, 1888, 446 p p., 100 pl.



manuscript volume of the Kew Herbarium there is a note by Hunter saying:—

“The districts visited will be described in the Monograph hereafter to be forwarded. They are mostly in the hills and they may be said to be between the 13° and 14° of N. Lat., and the 44° and 45° of E. Long.”

We have not been able to ascertain what “Monograph” he was alluding to or whether that Monograph has ever been published.

As most of Hunter’s specimens give as locality the “neighbourhood of Aden,” it is difficult to say which of his numerous plants were collected on the peninsula of Aden and which in Aden Hinterland. We shall, therefore, mention Hunter’s plants only in those cases where the same species has been reported from Aden by some other collector.

**J. W. Yerbury, 1884.**—Major Yerbury, well known for his valuable contributions to Aden Zoology, made a collection of 57 plants at Aden in spring 1884. Amongst them there was a new species which Ridley described under the name of *Albuca Yerburyi*.<sup>1</sup> The specimens are in the British Museum.

**H. R. Beevor, 1884.**—Dr. Beevor collected at Aden in November 1884. His specimens, which are not very numerous, were presented to Kew.

**G. Schweinfurth, 1881, 1888, 1889.**—Since the publication of Anderson’s *Florula* our knowledge of the flora of Aden had become more or less stationary. A few new species had been added to the list of Aden-plants, and some others had been observed at Aden which had escaped the collectors of earlier years, but the fact of their occurrence on that barren peninsula was not generally known. With Schweinfurth, however, who has done so valuable a work for the botanical exploration of the countries of the Red Sea, our knowledge of the vegetation of Aden has been greatly advanced. Keen eyes and an enormous store of information regarding genera and species enabled him to make many an interesting find in places where other collectors had looked for them in vain. Schweinfurth visited Aden during the following months: March 1881, November and December 1888, January and February 1889, and November 1889. Each time he had a rich harvest. The results of his travels, including his visit to Aden, were published in the “Bulletin de l’Herbier Boissier” under the title: “Sammlung arabisch-aethiopischer Pflanzen. Ergebnisse von Reisen in den Jahren 1881, 1888, 1889, 1891, 1892.”<sup>2</sup>

<sup>1</sup> Ridley, H. N. A new species of *Albuca* from Aden. Journ. Bot., Vol. 22 (1884), p. 370.

<sup>2</sup> Bulletin de l’Herbier Boissier (1894), Append. II, p. 1-113; (1896), Append. II, p. 115-266.

It is to be regretted that Schweinfurth was not allowed to complete this interesting contribution. The enumeration of his plants goes only as far as the *Euphorbiaceæ*. As to the remaining orders, Schweinfurth's Aden-plants were made use of in Krause's "Beiträge."

**A. Deflers, 1885, 1886, 1889, 1890.**—Deflers, the well-known French traveller, to whom we owe so much of our present information on Yemen,<sup>1</sup> stands undoubtedly foremost in the ranks of botanical explorers of Aden.

He visited this place for the first time in March and April 1885. Torrential rains had fallen almost without interruption from the 12th to the 14th March, and more abundantly still on the 21st. It is doubtless owing to this favourable circumstance that Deflers found an exceptionally great number of plants in flower and fruit, and amongst them several which had been very incompletely described before. Special interest attaches to his report in the "Bulletin de la Société de France,"<sup>2</sup> because it includes a number of specimens collected for the first time in Little Aden.

This list of plants mentions the following species which had not been noted in Anderson's Florula.

*Cleome brachystyla* Defl., *Maerua crassifolia* Forsk., *Gypsophila montana* Balf., *Corchorus trilocularis* Linn., *Fagonia parviflora* Boiss., *Crotalaria leptocarpa* Balf., *Crotalaria lupinoides* Hochst., *Indigofera semitrijuga* Hochst., *Indigofera paucifolia* Del., *Indigofera argentea* Linn., *Poinciana elata* Linn., *Cassia adenensis* Benth., *Acacia laeta* Defl., *Corallocarpus glomeruliflorus* Schweinf., *Trianthema pentandra* Linn., *Dobera glabra* DC., *Calotropis procera* R. Br., *Caralluma Forskalii* K. Schum., *Heliotropium pterocarpum* Hochst. & Steud., *Schweinfurthia pterosperma* R. Br., *Orthosiphon pallidus* Royle, *Salsola Bottæ* Boiss., *Atriplex farinosa* Forsk., *Boerhaavia verticillata* Poir., *Euphorbia polyenemoides* Hochst., *Forskohlea viridis* Ehrbg., *Littonia minor* Defl., *Dipcadi erythreum* Webb. & B., *Andropogon foveolatus* Del., *Andropogon Iwarancusa* Jones, *Aristida paradisæa* Edgew.<sup>3</sup>

Deflers visited the same places for a second time "towards the end of spring, 1886." We have seen labels giving the date "May 1886" but we are not sure whether it was only during this month that he collected at Aden and on Little Aden, or whether he prolonged his stay.

<sup>1</sup>Deflers, A.: Voyage au Yémen. Journal d'une Excursion botanique faite en 1887 dans les montagnes de l'Arabie Heureuse. Paris, 1889, 246 pp., 6 pl.

<sup>2</sup>Deflers, A.: Herborisations dans les montagnes volcaniques d'Aden. Bull. Soc. Bot. France, Vol. 32 (1885), pp. 343-356.

<sup>3</sup>These names are given in the nomenclature adopted below, which are not always Deflers'.

His harvest was less rich on this occasion than on the former, but most species were new with regard to their locality. He tried in vain to find *Albuca Yerburi* Ridley, and was as unsuccessful in his search for 15 species mentioned by Anderson. In his report<sup>1</sup> on this excursion he describes briefly the physical aspects of Little Aden and institutes a short comparison of its flora with that of Aden. In both papers taken together, he mentions 148 species belonging to 104 genera. We find the indefatigable botanist once more in Aden and its neighbourhood in winter 1889-90, always adding new finds to his former lists.<sup>2</sup> The plants collected during this excursion together with those of 1893 and 1894 gathered all along the Gulf of Aden, between 42° and 44° E. Long. (Paris), amounted to 555 species, amongst which there were about 30 new to science.<sup>3</sup>

**W. Lunt, 1894.**—In 1893, William Lunt, a member of the gardening staff of the Royal Gardens of Kew, was appointed, with the approval of the First Commissioner of Her Majesty's Works and Public Buildings, botanical collector for Kew to Theodore Bent's expedition<sup>4</sup> to the Hadramaut Valley in South Arabia. The flora of that part was only conjecturally known up to that time and no botanical collections appear ever to have been made in it.

The expedition left London on the 25th November 1893. Taking the overland route to Marseilles they joined the *Melbourne* (Messageries Maritimes Co.) which arrived at Aden on the 7th of December.

"On landing," says Lunt "one sees that Aden is apparently a perfectly barren place, for not a scrap of green is to be seen, a state of things not calculated to inspire a plant collector with enthusiasm. However I proceeded, after making careful enquiries as to the most likely places in which to find plants, to commence the work which was the object of my journey. My first impression of the total barrenness of the place was soon dispelled on exploring the numerous valleys among the hills at Steamer Point. I soon found an ordinary vasculum to be too small, and to be filled in a very short time. The black colour of an

<sup>1</sup>Defflers, A.: Nouvelles contributions à la flore d'Aden. Bull. Soc. Bot. France, Vol. 34 (1887), p. 61-69.

<sup>2</sup>Defflers, A.: Descriptions de quelques plantes nouvelles ou peu connues de l'Arabie méridionale. Bull. Soc. Bot. France, Vol. 42 (1895), p. 297-306; Vol. 43 (1896), p. 104-123, 218-234.

<sup>3</sup>Defflers, A.: Plantes de l'Arabie méridionale recueillies pendant les années 1889, 1890, 1893 et 1894. Bull. Soc. Bot. France, vol. 43 (1896), p. 321-332.

Defflers, A.: Les Asclépiadées de l'Arabie tropicale. Mém. de l'Institut. d'Egypte, Vol. 3, p. 270.

Defflers, A.: Esquisses de géographie botanique. Le Caire.

<sup>4</sup>Kew Bulletin (1893), p. 366.

ordinary vasculum is, too, a great disadvantage in tropical countries, for black objects radiate heat so quickly that flowers and the young parts of plants are soon shrivelled up. A large covered basket lined with some material to prevent the free circulation of air is very useful. During a stay of a few days I obtained nearly 50 different species of plants.”<sup>1</sup>

As the specimens were not sufficiently dry to pack up before the party left Aden, Lunt took them with him to Makalla.

“I succeeded,” says Lunt in his “Journal,” “in drying them before the time came for our departure from that place, and left them there until our return. When we returned I was disappointed and irritated to find that they had been stolen, and that nothing could be done to recover the plants. Consequently the numbering here will commence at 47.

“On returning to Aden I set to work to reform the collection. I found almost all those I had lost, and in addition some extra specimens.”<sup>2</sup>

Bent’s expedition was successful, but the opposition of the natives limited the extent of the explorations. The party retraced Hirsch’s route very closely, both in coming and going. They made only one important deviation from the tracks of predecessors. It was a short excursion from Shibam up the Wady Ser, which comes down from the north, carrying a little used caravan path from the desert. “Bent’s party met with much the same reception as Hirsch: bare tolerance, on condition it travelled neither far nor long. Much less able to enter into intimate relations with the native society than his predecessor, Bent brought back less full and exact information. But his party was the better equipped and able to use the camera and take observations.”<sup>3</sup>

Lunt’s botanical collections were excellently prepared and preserved, and contain many interesting novelties, including two new genera and 25 new species from Hadramaut of such genera as *Aloe*, *Adenium*, *Arthrosolen*, *Littonia*, *Statice* and *Vellozia*.<sup>4</sup> Even at Aden Lunt found several species which had not been observed by other botanists in that place. The plants from Hadramaut were named and described by J. G. Baker in the Kew Bulletin of 1894.<sup>5</sup> The type specimens, together with the plants collected at Aden, are kept at Kew.

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<sup>1</sup> Report of W. Lunt on the Hadramaut Expedition. In ms. volume, Herb. Kew, entitled: “Hadramaut, Bent’s Expedition, 1893-94.

<sup>2</sup> Journal of W. Lunt. In ms. volume Herb. Kew.

<sup>3</sup> Hogarth, D. G.: The Penetration of Arabia. London, 1904, p. 220.

<sup>4</sup> Kew Bulletin (1894), p. 194.

<sup>5</sup> Kew Bulletin (1894), p. 328-343.

"Lunt's<sup>1</sup> notes and collections," says Hogarth, "served to supplement and check the valuable paper on Hirsch's specimens, contributed by Schweinfurth." But we have not been able to find Schweinfurth's paper.

**W. S. Birdwood, 1897, 1898.**—By far the most complete collection of Aden plants is the one made by Colonel and Mrs. W. S. Birdwood. Two collections were received at Kew, one in July 1897 and the other in August 1898. The specimens are admirably prepared and well preserved. A complete set of Birdwood's plants is kept in the Herbarium of the Bombay Natural History Society. It is from this collection that I compiled a list of Aden plants in 1907.<sup>2</sup>

**O. Simony, 1898, 1899.**—Oskar Simony belonged to an Austrian scientific expedition to Southern Arabia and Socotra, undertaken in the year 1898 and 1899. Of his botanical collections, as far as they include Aden, nothing has been published up to now, except the Lichens, which were described by J. Steiner in the "Denkschriften der Wiener Akademie, 1907."<sup>3</sup>

Simony's collection of phanerogamic plants is being worked out by Vierhapper. Part I, describing the vegetation of some islands (Semha etc.), was published in the same "Denkschriften" of 1907<sup>4</sup>; Part II is announced to contain the plants of Southern Arabia, including Aden, whilst Part III will be devoted to the discussion of general results.

**Ellenbeck, 1899.**—Dr. Ellenbeck accompanied the expedition of Baron von Erlanger to Somaliland. Before their immediate departure for that country they visited Aden in December 1899. Ellenbeck gathered 65 specimens of plants which are preserved in the Botanical Museum of Berlin.<sup>5</sup>

**Marie Hein 1900-01.**—Dr. Wilhelm Hein and his wife made a stay of several weeks in Aden preparatory to their tour to Kishin. Frau Dr. Hein kindly informed me that during that time she devoted her attention to the one surviving Frankincense-tree near the Tanks, because Professor von Wettstein had expressed his wish to have a few flowers of that plant. But it was only after their departure that the

<sup>1</sup>W. Lunt, born 1871, died at St. Kitts, West Indies, 3rd January 1904 (*Cf.* Journal, Kew Guild 1904, p. 203-209).

<sup>2</sup>Blatter, E.: The Flora of Aden. Journ. Bomb. Nat. Hist. Soc., Vol. 17, p. 895-920 a, Vol. 18, p. 54-68.

<sup>3</sup>Steiner J.: Bearbeitung der von O. Simony 1898 und 1899 in Südarabien, auf Sokotra und den benachbarten Inseln gesammelten Flechten. Denkschr. Wiener Ak. Vol. 71 (1907), p. 93-102.

<sup>4</sup>Vierhapper: Beiträge zur Kenntnis der Flora von Südarabien, Sokotra, Semha und Abd el Kari. Erster Teil. Denkschr. Wiener Ak. Vol. 71 (1907), 170 pp., 17 pl.

<sup>5</sup>Krause: l. c., p. 8.

German Consul, Mr. Schmuck, was able to send flowers and leaves, preserved in spirit, to Vienna.

In the meantime Dr. and Mrs. Hein had left Aden and reached Kishin on the 25th January 1901. Kishin lies east of Aden, beyond Makalla, not far to the west of Ras Fartak, on the Hadramaut coast, in about lat.  $15^{\circ} 25' N.$ , long.  $51^{\circ} 30' E.$  Whilst Dr. Hein collected much valuable linguistic material, Frau Dr. Hein devoted herself more to the natural history of Kishin, and collected, in addition to many Zoological specimens, about 100 species of plants, in each case with the local names<sup>1</sup>. On their return to Aden, they spent a month at Shaikh Othman. The botanical specimens were presented to the Botanic Institute of Vienna, but, as far as we know, no scientific report has appeared up to now.<sup>2</sup>

**K. Krause, 1905.**—Krause published in 1905 his "Beiträge zur Kenntnis der Flora von Aden."<sup>3</sup> He enumerates, without giving the description, 178 species as growing in Aden and Little Aden. His paper was the most comprehensive publication on the flora of Aden after the appearance of Anderson's *Florula*. Krause has not visited Aden, but, according to his own statement, the specimens of the following collectors were at his disposal: Hildebrandt, Schweinfurth, Ellenbeck, Busse, and to a great extent, Deffers. He made, besides, use of the publications on Aden in various scientific Journals.

In the introduction he gives an account of the physical and meteorological aspects of the two peninsulas, with some general considerations on the flora of Aden and statistical observations on its relations to the vegetation of the neighbouring countries. The catalogue is followed by a list of 40 species of plants collected in the Aden Hinterland by Ellenbeck and Busse. Finally, he gives an interesting description with illustrations of the means of propagation of the plants indigenous in Aden, which leads to more or less probable conclusions as to the origin of the Aden flora.

In addition to the collectors and botanists mentioned above, the following have gathered a few plants at Aden.

Dr. **Boycott** (plants at Kew); **D. F. A. Hervey** (plants received at Kew in March 1892); and three others whose names are known to us from printed reports only, **Balansa**, **Remy**, **Perrotet**.

<sup>1</sup> Geogr. Journ., Vol. XX (1902), p. 226.

<sup>2</sup> Dr. W. Heim published a paper in the Mitt. d. K. K. Geogr. Ges. Wien, Vol. 46 (1903), 219-264, entitled "Ein Beitrag zur Statistik Südarabiens," but this article has nothing to do with the natural history of the country explored.

<sup>3</sup> Krause, K.: Beiträge zur Kenntnis der Flora von Aden. Engler's Bot. Jahrb., Vol. 35, Heft 5.

**Collections consulted.**—The following collections of Aden plants, kept at Kew, the British Museum, in the Museum of the Bombay Natural History Society and in the Herbarium of St. Xavier's College, Bombay, have been consulted for the present work:

Salt, Edgeworth, J. D. Hooker, Madden, Schomburgk, Thomson, Playfair, Anderson, Oliver & Cleave, Hildebrandt (partim), Arnesley, Kuntze, Perry, Balfour, Schweinfurth, Hunter, Beevor, Yerbury, Deflers, Hervey, Lunt, Birdwood, Boycott.

## II. PHYSICAL ASPECTS OF ADEN.

**1. Area and Position.**—The area of which we are going to describe the vegetation, is indicated on the accompanying map. It comprises the whole British territory. This was formerly limited to the peninsula of Aden proper, extending to a creek named Khor Maksar about 2 miles to the northward of the defence works across the isthmus. The island of Sirah, which is now connected with the mainland by a masonry causeway, and the peninsula of Jebel Ihsan, or Little Aden, were acquired by purchase from the Sultan of Lahej in 1868. As the population of Aden town increased rapidly, Government purchased a further small tract of territory beyond the Khor Maksar creek in 1882, extending to just beyond the village of Imad on the north and to Shaikh Othman on the north-west, about 10 miles from Bandar Tawayih, or Aden Back Bay.<sup>1</sup> The total area of the British territory is 75 square miles. Aden, which is almost the most southerly point on the south coast of the Province of Yemen in Arabia Felix, is situated in latitude  $12^{\circ} 47' N.$ , and longitude  $45^{\circ} 10' E.$

**2. Geology.**—The peninsula of Aden is about 15 miles in circumference, of an irregular oval form. The greater diameter is 5 miles, whilst the lesser measures only 3. The whole is connected with the continent by a low narrow neck of land, 1,350 yards broad, but which is in one place nearly covered by the sea at high spring-tides. As a matter of fact, it would be flooded, were it not for a causeway constructed for the convenience of the land traffic, and the passage of the Shaikh Othman aqueduct.<sup>2</sup>

The promontory of Aden consists of a bold cluster of volcanic rocks with lofty jagged peaks. The loftier portions of it are wholly volcanic and the lower are partly volcanic and partly consolidated sea-sand. The most interesting portion is an immense, nearly circular crater, situated at the eastern extremity of the promontory next the main land, and within which, upon a flat, little raised above the sea-level, stands the town of Aden. Although the crater appears at first sight almost perfect, it has been affected by some rude shocks which have cleft it entirely through from north to south, forming two rents, known as the northern and southern passes. The portion to the west of the fissures is called Jebel Shum Shum. It stands entire and rises to a height of 1,775 feet. That to the east has evidently undergone a partial subsidence, attaining to not more than half the height of the western side. For the distance of about half a mile it has been broken down allowing the sea to come close

<sup>1</sup> Imperial Gazetteer of India, Vol. V, p. 9.

Munter F. M. : An account of the British Settlement of Aden. London, 1877, p. 1.



to the town and to form a little bay, known by the name of Front or East Bay.<sup>1</sup> The appearance of the island of Sirah would induce the belief, that it had at one time completed the circle of the crater, but that, having been separated by some convulsion of nature, it had been carried out and deposited in the sea, a few hundred yards in advance of the gap caused by its removal.

The external side of the crater is more or less scarped, and separated from the high peaks and ridges which flow from it, and in this scarped portion may be seen lines of horizontal stratification. Also some distance up the side of the slope which descends towards Back Bay may be seen a small series of strata, consisting of pisolitic peperine, cemented together with glassy crystallized gypsum. From the manner in which the pieces of pumice, basalt, and obsidian of which it is composed are arranged, together with the fact of the cement being sulphate of lime, we must conclude that it was deposited in the sea, and afterwards raised to its present position. At one part it is at least 200 feet above the level of the sea, though it descends to the water's edge in another.<sup>2</sup>

To the northward of the great crater is an immense mass of lofty and jagged volcanic products, probably the remains of smaller craters.

The crater as well as the whole volcanic mass has been greatly altered by the action of the sea and rain since the time when the volcano was active. "To passing travellers," says Mallet, "it may appear strange to speak of pluvial denudation at Aden, but residents of the place are well acquainted with its force and extent. Rain seldom falls, it is true, but when it does, it generally comes down in torrents."<sup>3</sup>

The peninsula of Little Aden is larger than Aden. Geologically considered it is of the same origin as the peninsula of Aden, and shows on the whole the same physical characteristics. It is impossible to recognize the ancient vent of the volcano; the rocks do not form a circular crater as is the case at Aden, but rise independently from the sandy plain, without indicating any connection between themselves or pointing towards a common origin, except by their mineral composition.

Little Aden is dominated by the Jebel Muzulghum and the Jebel Ghudir, two precipitous mountains which terminate in lofty inaccessible peaks. Jebel Muzulghum traverses the peninsula from north-west to

<sup>1</sup> "A letter, dated Madras, July 1840, addressed to John Tayler, Esq., Treas. G. S. by Mr. Frederick Burr, on the Geology of Aden on the coast of Arabia," Journ. Bomb. Br. Roy. As. Soc. Vol. I, 1841, p. 83-84.

<sup>2</sup> Carter, H. J. : Memoir on the Geology of the South-East Coast of Arabia. Journ. Bomb. Br. Roy. As. Soc., Vol. IV, 1852, p. 85.

<sup>3</sup> Mallet, F. R. : On the geological structure of the country near Aden. Mem. Geol. Survey, India, Vol. VIII, part 3 (1871), p. 4.

south-east, and rises to a height of 1,218 feet. Jebel Ghudir runs along the southern coast, where its spurs produce deep indentations on the coast line. These small promontories are called, beginning from west : Ras Alarga, Ras Mujallab Heidi, Ras Abu Kiyama, and Ras Salil. On the easternmost promontory of the peninsula there rises the Jebel Ishan to a height of 697 feet. Along the Bandar Fukum, a bay formed by the peninsula and the continent, there stretches a chain of low hills, called Jebel Fukum.

The igneous rocks consist of basalt in almost all its forms, compact, black, grey peridotite; rough, cellular, scoriaceous, variolitic; tephritic, with small crystals of glassy felspar, which forms some of the high peaks in the interior of the crater; leucostine, which forms part of the lavigenous effusions in the north-west part of the peninsula, where the last vents of the volcano appear to have existed; pumite and stigmite, simple, variolitic, and pisolitic, which form small deposits in various parts of the general mass, and semiopal and chalcedonies, which abound in the island of Sirah. To these may be added brown carbonate of lime, in columnar stratified crystalline deposits, with transverse wavy lines; massive and fibrous gypsum; and fluor spar in minute crystals of an amethystine colour on the surface of chalcedonies.<sup>1</sup> There are lavas containing crystals of anjite, and not unfrequently those of sanidine. The rocks exhibit every degree of vesicularity; the vesicles are in some specimens globular, and in others flat and drawn out. In some places the lava is quite schistose, and might be easily taken for metamorphic rock. Volcanic breccias are also met with, as near the Main Pass, where fragments of dark green lava are embedded in a reddish matrix.<sup>2</sup> Tufas are also present, but apparently to a limited extent. "With reference to the Aden pumice, it was found that this differed from ordinary pumice in containing gypsum or hydrated sulphate of lime. In the specimens examined the quantity of this constituent was found to be 18.68 per cent."<sup>3</sup>

The deposits of consolidated sea-sand occur more especially near the Northern Pass, towards the base of the volcanic ridges, raised sometimes 15 or more feet above the level of the sea. The stratification is diagonal, and this arrangement has probably been produced by the drifting of opposing currents. The flat line of coast on the northern part of the promontory is evidently a raised beach, and the consolidation of the sand must be assigned to the action of a tropical sun upon the calcarious

<sup>1</sup> Carter, H. J. : l. c., p. 85.

<sup>2</sup> Mallet F. R. : l. c., p. 4.

<sup>3</sup> Report of the Chemical Analyser to the Government of Bombay for the year 1872-73.

materials. The rock encloses numerous shells and corals of species existing in the Arabian Sea.<sup>1</sup>

As to the origin and age of the two peninsulas, there are only a few facts which may serve as a basis for further conclusions.

Although our geological knowledge of Arabia is lamentably deficient, we know from the researches of Carter and Blanford in the south, and from the observations of Blunt and others in the north, that Arabia must be considered as the eastern portion of the great Saharan desert plateau. As in the Egyptian deserts, the basis of the country consists of crystalline rocks, overlain by horizontal sedimentary formations of Cretaceous and Eocene age.<sup>2</sup> If Arabia may be regarded geologically as part of the African plateau, it is evident that the Red Sea must have been formed by subsidence of the country in comparatively recent times, with great probability at the beginning of the Middle Pliocene.

Whether the formation of the volcanoes in Aden and along the coast between Tair and Perim was immediately connected with the disappearance of that vast stretch of firm land, or whether it dates back to a more recent terrestrial convulsion, is difficult to decide from the scanty geological data we possess regarding the countries of the Red Sea.<sup>3</sup>

On leaving Aden we come on a low-lying sandy plain, on which generally nothing but a small scrubby bush will grow. The water which is to be met with at a depth below the surface varying from 3 to about 18 feet throughout this tract, is directly influenced by the rise and fall of tide. It is, of course, brackish to a degree, being in fact almost, if not quite, simple sea-water. This tract of sand extends nearly to Shaikh Othman north, and skirts the foreshore of Aden Bay and the coast-line eastward, as far as El Konis, extending inland in a belt of varying thickness, sometimes running right up into the sand-drift, at others only a few hundred yards from the sea-coast.

Between this salt belt and the hills is an alluvial plain falling from the hills towards the sea, with a slope near the foot of the hills of about 30 feet in a mile, easing off to about 17 feet in a mile, till it reaches the salt belt, which is very nearly dead level. The soil of this part of the country is composed of a sandy clay, very retentive of moisture, and capable of high cultivation. Throughout this alluvial tract of country a slightly brackish, but drinkable water, is met with at a depth of from 60-70 feet. The water-bearing stratum seems nearly parallel to the

<sup>1</sup> Burr, F. : l. c., p. 84.

<sup>2</sup> Geographical Journal, Vol. 32 (1908), p. 568.

<sup>3</sup> Suess, E. : Das Antlitz der Erde. I, p. 474.

Lapparent, A. de. : Géographie Physique. Paris, 1896, p. 528.

surface of the soil when the latter has fairly taken its incline after leaving the coast.<sup>1</sup>

Not far from the village of Shaik Othman and on the northern side of the harbour, the bed of a mountain torrent, the Wadi Kabir, meets the sea. After very heavy rains on the neighbouring hills, the flood occasionally empties itself into the harbour by this outlet.

**3. Topography.**—In order to help future visitors at Aden to find the localities in which the different species of plants described below have been observed, and to enable collectors to append correct localities to their specimens, we give in the following the topography of the area under consideration.<sup>2</sup>

The town of Aden and part of the military cantonment are at the eastern end of the peninsula, situated within the crater,—and surrounded on all sides by hills, except on the eastern face, where a gap exists. The town consists of white-washed houses built of stone and mud, divided regularly into streets and lanes.

The dry bed of a water-course runs down to the sea from the valley in which the tanks are situated and divides the town into two nearly equal parts. It serves to carry off the surplus of water when the reservoirs have been filled to overflowing.

There are three outlets from the crater. To the south, a gate protected by a drawbridge leads into Hokkat Bay, where the English Cemetery (opened in 1866) is situated. Further south lies the promontory of Marshag, on which is placed a lighthouse 244 feet above sea. The second outlet is by a tunnel which leads from the crater into the Isthmus position.

To the northward lies the Main Pass through which the harbour is reached. A steep hill forms the approach to this entrance on the town side, whilst on the harbour side a considerable decline has to be traversed by tortuous windings before the sea-level is reached; the road finally turns off in a westerly direction. A road leading into the interior, and which is connected with one of the gates of the Isthmus position, branches off from the main road. At the limit of the fortifications there is a pier of obstruction and Barrier Gate.

About half a mile from the foot of the Main Pass the road coming from the town reaches the village of Maala. This consists partly of houses built of stone, but chiefly of mat-huts, occupied by Somalis. A pier runs out from the foreshore, alongside which native craft can lie and discharge cargo.

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<sup>1</sup> From a report on the physical geography of the neighbourhood of Aden by Major Walter Ducat, R.E., in Hunter, *l. c.*, p. 17.

<sup>2</sup> We follow closely Hunter's "Account of Aden," cited above.

Proceeding along the road about a mile to the westward, another pass has to be crossed where a spur of the main chain of hills runs down to the sea. After a few windings in and out along the water's edge, Steamer Point is arrived at, where there is a crescent, called Prince of Wales Crescent, consisting of some fair-sized stone houses. Behind these are several streets of double and single-storied houses reaching to the hillside.

Close by, north-west of the crescent, lie the coal grounds of Government and the various steam navigation companies which have depôts at Aden. Not far from these to the north-westward is the landing-pier. Beyond and close to the sea-shore are situated a few buildings, including the Police Court and Post-office. Above this part of the road, on a spur which is connected with the more lofty hills in the interior of the peninsula, barracks, a hospital, and other public buildings have been erected, as also the residences and offices of the Harbour-master, the Peninsular and Oriental and Messageries Maritimes Companies' agents. On a conical hill about a quarter of a mile beyond the Post-office stands the station flagstaff, below which lies the Protestant church. Near this the road crosses the spur on which the barracks, etc., are situated, and after traversing in a south-westerly direction a plain of about 500 yards in extent, it terminates on Ras Tarschyné. On this headland are built the residency and the mess-house and quarters of the officers of the Royal Artillery.

On Ras Baradlee to the south, the Eastern Telegraph Company have erected a handsome office.

South-east of the Telegraph building there opens, between two narrow promontories a broad valley, the so-called Goldmore Valley, which rises from the sea up to the circular ridge enclosing the crater. Not far from the point where the two spurs, which enclose the valley, meet, there is the Shum Shum Flagstaff. At some distance east of the Flagstaff there is a narrow ravine, the Koosaf Valley, and to the north-east a somewhat broader valley, the Biggari Valley.

The island of Sirah commands the eastern bay and town of Aden. It is a somewhat triangular rock about 430 feet high towards the northern end, and half a mile long by 600 yards broad. In former times it was entirely cut off from the peninsula of Aden, but already as early as 1839 Captain Haines wrote: "Of late years the sand has filled up the small creek which used to separate it from the main land, consequently at low water it is now joined to the coast of Arabia." <sup>1</sup>

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<sup>1</sup> Haines, S. B.: Memoir to accompany a Chart of the South Coast of Arabia from the Entrance of the Red Sea to Misenat, in 50° 43' 25" E. Journ. Roy. Geogr. Soc. Lond., Vol. 9 (1839), p. 133.

Bandar Towayih or Aden West Bay, more generally known as Aden Back Bay, is formed by the peninsula of Little Aden in the west and Aden on the east. It is about 8 miles broad from east to west, by 4 miles deep. It is divided into two bays by a spit, which runs off half a mile to the southward of the small island of Aliyah. The entrance between Ras Salil of Little Aden and Ras Tarshyne of Aden is  $3\frac{1}{2}$  miles in width. The depths of water in the Western Bay are from 3 to 4 fathoms and the bottom consists of sand and mud.

There are several islands in the inner bay. The eastern and principal, named Jazirah Sawayih, usually called Slave Island, rises 300 feet high and is almost joined to the mainland at low-water springs. The others are called Marzuk Kabir, Kais-al-Hamman, Kalfatain or Twin Rocks, and Faringi. On the sand-spit, at the north side of the entrance into the inner bay, are two small islets named Jamah Aliyah. Opposite Ordnance Bay is the island Shaikh Ahmad or Flint Rock.

**4. Conditions of plant-life.**—Water may be regarded as the most important of all factors which affect the plant. The water content of the soil acts upon the roots, regulating the water supply, and the humidity of the air exercises its influence upon the leaves, regulating the water loss.

We understand by water content of a certain place the total amount of water in the layer of soil occupied by the roots. The water of the lower strata is not properly water content because it is of no use to the plant. No experiments have ever been made at Aden to show the exact amount of water content in the different localities of our area. As the water content, however, depends largely upon the effect of the other factors of the habitat which have an influence either direct or indirect upon the amount of water present, a short consideration of those factors concerned, *viz.*, soil, rainfall, humidity, and temperature, will help us to arrive at a satisfactory, though not exact, conclusion.

(a) *Soil.*—The soil is of the greatest importance in determining not only the amount of water content, but also the kind of water, *i.e.*, the chemical substances found in solution. The physical properties of the soil, *viz.*, its texture or fineness, determine the amount of water present, whilst the chemical nature of the soil indicates the kind and amount of nutrient material dissolved in the water.

The structure of the soil has an almost absolute control upon the fate of the water that enters the ground, in addition to its influence upon the water that runs off. The amount of water drained away in response to gravity and the amount that can be raised from the lower strata by means of capillary action are entirely regulated by the physical properties of the ground. As the soils are formed from rock by the action of weathering, its structure will greatly depend on the particular process of

weathering, which may be either disintegration or decomposition. Though these two processes usually go hand in hand, it may generally be observed that one is more prevalent than the other. An examination of the surface of the hard volcanic rocks of Aden and Little Aden will at once reveal the fact, that decomposition is not very active, whilst the watercourses with their boulders and gravel show to evidence that disintegration, *i.e.*, the breaking up of the rock into fragments of various size, is continually at work. It is only after a long period that the minor fragments exhibit distinct signs of decomposition and begin to form soil. Besides the natural hardness of the Aden-rock and its power of resistance against climatic influences, decomposition is greatly retarded by the almost entire absence of Lichens. On the highest peaks of the Alps and other lofty mountains, in the temperate as well as in the tropical regions, we find many species of crustaceous Lichens, which contribute materially to the weathering of the rocks and to the formation of a vegetable soil. But at Aden very few species are represented forming here and there some small, almost invisible patches.

As the water is found in the form of thin films surrounding the soil particles, the amount necessarily increases with the increase of the water-holding surface. The latter is increased as the particles become finer and more numerous. At the same time the irregular capillary spaces between the particles grow smaller and, in consequence of it, the upward or capillary movement of the water is increased, whilst the downward movement or percolation is retarded. Judging from the geological and mineralogical characters of Aden and from the way in which, under similar circumstances, the formation of soil generally takes place, we must conclude, even if we did not know it by experience, that the soil is coarse-grained and highly porous. But porosity decreases the water content of the upper layers, the water not being absorbed, but passing through the upper layers in order to occupy the lower layers or to flow off as local circumstances may demand it. This is the reason why so-called dry habitats, such as prairies, gravel-slides, sand-hills, etc., have a low water-content, varying from 3 to 15 per cent. There is no doubt that the same obtains at Aden, not only with regard to the soils formed from the volcanic rocks but, *a fortiori*, regarding the sand fields of the isthmus and the British territory in general.

As to the chemical composition of the soil of Aden there is not much to be said. The quantity and quality of soluble substances in all ordinary habitats are so nearly alike that differences in chemical composition are of little importance. The soil in the valleys, ravines, and watercourses of Aden and Little Aden, and wherever else there is a deposit of

soil formed by the weathering of the lava, offers no special feature which might not be met with, *v.g.* on the vast Deccan plateau of India, except for the fact that the amount of humus at Aden, owing to the scanty vegetation, is unusually small.

The soluble materials, however, play an important part only in those localities of our area, where they are present in excessive amounts. This is the case on the isthmus and on the flat sandy portion of the British territory generally, including the low sandy shores of both peninsulas, where the soil is impregnated with considerable amounts of alkali. The term alkali is applied rather loosely to the more readily soluble saline matters which accumulate in the soils or in the water of desert regions. In spite of the name such salts are mostly neutral in reaction consisting chiefly of chlorids, sulphates, and nitrates of the bases sodium, potassium and magnesium. Only the carbonates of sodium and potassium, constituting the much-dreaded "black alkali," are strongly alkaline in reaction, and on account of their caustic nature much more deleterious to most plants than are the neutral salts or "white alkali." The effect of alkalis upon water content and absorption is not altogether understood. Experiments indicate that they are injurious chiefly indirectly by rendering the soil water too concentrated a solution and thereby unfitted to nourish the roots. No analyses have been made which represent accurately the conditions in the soil water of the localities indicated, but there can be no doubt that the soil is highly alkaline. If the origin of the soil and its present position are not sufficient to substantiate this statement, then the unmistakable character of the plants that grow upon it must clearly establish the fact.

(b) *Rain.*—The dependence of water content upon rainfall is absolute in all localities except those where the supply of water is constant, owing to the presence of springs, streams, ponds, or other bodies of water. As none of these latter sources of supply are to be found at Aden,<sup>1</sup> the rainfall is the only factor to be considered in this place.

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<sup>1</sup> Aden is not devoid of wells and tanks, and even of torrents during a very short time immediately after a rainfall, but they are not of such a character as to furnish a constant supply to the needs of the vegetation or to modify in any way the water content of the soil. According to Hunter, water of a good quality is found at the head of the valleys within the crater and to the west of the town. Wells are sunk in the solid rock to a depth of from 120 to 190 feet; in the best the water stands at a depth of 70 feet below sea level; it yields a daily average of 2,500 gallons. The temperature of the water is 102° F., the specific gravity .999, and it contains 1.16 parts of saline matters in every 2,000 gallons.

The tanks and reservoirs in which to store rain-water are about 50 in number, and if entirely cleared would have an aggregate capacity of nearly 30 million imperial gallons. In 1856 the restoration of these magnificent public works was commenced, and 13 have been completed (up to 1877), capable of holding 7,718,630 gallons of water.

A very moderate fall of rain suffices to send a stupendous torrent of water down the valleys which, ere it reaches the sea, not unfrequently attains the proportions of a river. (From Hunter, p. 10-13.)

Since the restoration of the tanks they have only been filled six times, in May 1866, May 1870, and September 1877, 1889, 1893, 1897.



The annual rainfall at Aden rarely exceeds 6 or 7 inches, while occasionally there falls no rain for a year and a half. "Rain seldom falls," says Mallet, "but when it does it generally comes down in torrents. Of Aden it may be said with some degree of truth that there 'it never rains but it pours.' During the last fall which has occurred (1870) seven inches fell in a couple of hours. The water swept along the torrents, filling all the drains with stones, many of them bigger than a man's head, and doing considerable damage to the station. Such very heavy falls only occur once in ten years or so, but other smaller but still heavy ones occur at shorter intervals."<sup>1</sup>

The subjoined readings give the registered rainfall in the Crater from 1871—1876. Previous to that year the maximum recorded in the preceding eleven years was 8·03 inches in 1870, while in 1871 the fall amounted to 24 cents only.

Rainfall registered at the Civil Hospital in the Crater :—<sup>2</sup>

MONTHS.	1872-73.		1873-74.		1874-75.		1875-76.	
	Inches.	Cents.	Inches	Cents.	Inches.	Cents.	Inches.	Cents.
April . . . . .	1	9	0	0	0	0	0	0
May . . . . .	0	20	0	10	0	0	0	2
June . . . . .	0	0	0	0	0	0	0	0
July . . . . .	0	41	0	2	0	0	0	0
August . . . . .	0	98	0	27	1	58	0	0
September . . . . .	0	21	1	28	0	0	0	0
October . . . . .	0	0	0	0	0	0	0	0
November . . . . .	0	0	0	12	0	5	0	22
December . . . . .	0	42	0	11	0	0	0	18
January . . . . .	0	85	0	45	0	0	1	49
February . . . . .	0	0	0	0	0	42	0	17
March . . . . .	4	53	0	0	0	0	1	65
TOTAL . . . . .	8	69	2	35	2	05	3	73

At Steamer Point the following totals of rainfall have been observed<sup>3</sup> during the years 1907-1911 :—

Year.	1907.	1908.	1909.	1910.	1911.
Total rainfall .	0	1·3	·73	3	1·55

<sup>1</sup> Mallet, F. R., in Memoirs Geol. Surv. India, Vol. VII, pt. 3, p. 4.

<sup>2</sup> Hunter l. c.

<sup>3</sup> Kindly supplied by Lieutenant-Colonel. S. E. Prall, I.M.S.

As the hills on the western side of the Crater are precipitous, the rain-water descending from them is carried rapidly to the sea by means of a number of long narrow valleys unconnected with each other. On the eastern side the hills are quite as abrupt, but the descent is broken by a large table-land occurring midway between the summit and the sea-level, which occupies about one-fourth of the entire superficies of Aden. The plateau is intersected with numerous ravines, nearly all of which converge into one valley, which thus receives a large proportion of the drainage of the peninsula. As slope (*i.e.*, the inclination of the surface of a locality with respect to the horizon) controls the run-off and drainage, and through them the water content of the soil, we can easily understand how the steepness of the hills, the hardness of the rocks, and the scarceness of soil upon them combine to prevent any great amount of absorption.

Almost perpetual drought is, of necessity, the consequence of such physical and meteorological conditions. It is, indeed, only after a rainfall that the soil of the valleys is uniformly moistened throughout, so that the plants are able to draw the necessary supply of water even from the upper layers of the ground. After a very short time the rainwater partly evaporates, partly sinks deeper, and either flows off on the hard inclined rock, or is collected in subterranean reservoirs.

No observations regarding the effect of rainfall upon water content have been made at Aden. It is best ascertained by taking samples of soil in different localities immediately after a rain, and then determining the increase in water content. Irregularities in the surface of a locality which retard the movement of run-off and cause more of the rain to soak into the soil, ought to be specially noted. Their influence is generally not very great, but it is always appreciable. In some cases it is of considerable importance, as may be judged *v.g.* from the vegetation in the lower part of the broad valley between Steamer Point and Maala.

(c) *Humidity and temperature.*—Humidity is an important factor determining to a great degree the water content of the soil. It acts upon the plant and upon soil water in the same way, *viz.*, by controlling evaporation. Water content is affected directly through water loss from the soil, and indirectly inasmuch as the water lost by the plant is first drawn from the substratum. Since humidity is a direct factor, it ought to be more fully considered in this place, but, unfortunately no statistical observations on the subject are at our disposal. All we know is, that Aden is considered to be exceedingly dry; and if we are allowed to conclude from the character of its flora, there can be no doubt on this point.

As humidity is considerably influenced by temperature and wind, high temperature lowering the percent of relative humidity and low temperatures raising it, we shall, as far as reliable records go, briefly discuss those climatic factors.

The climate of Aden during the north-east monsoon (October to April) is cool, and in the months of November, December, and January pleasant and agreeable. During the rest of the year hot sandy winds known as "Shamal" or north, prevail within the crater. On the western side, however, or Steamer Point, the breezes coming directly off the sea, are cool and refreshing. Van den Broeck, who visited Aden in 1614, was witness of the Shamal and described it thus :

"About Monday there came upon the earth a surprising darkness, followed by heavy rain, and in the further extremity of that terrible cloud a very bright red, that might almost be mistaken for a fiery oven. The cloud continued to roll away towards Ethiopia, the rain ceased, and we were surprised to find our vessel covered with red sand, to the thickness of a finger's breadth. Some intelligent inhabitants informed us that these winds were formed of the sea-sand, and often buried whole caravans."<sup>1</sup>

Playfair calls this a tolerably accurate description of the Shamal, but he adds that usually it is not accompanied by rain, nor even so serious in its results.

Anderson gives us a vivid description of the climate of Aden in his *Florula Adenensis* :

"In so low a latitude," he says, "the sun shines with intense force nearly throughout the year, and at Aden the solar power is increased by every peculiarity of physical conformation and climate. The undisturbed atmosphere stagnates in the walled-in valleys, where a death-like stillness always reigns. The black and naked rocks absorb by day the scorching rays transmitted through an ever cloudless sky, only to radiate the pent-up heat by night, thus confining to the shore the cool but feeble breezes that occasionally spring up from the Indian Ocean. Accordingly, even in December, when the sun's power is at its lowest, Dr. Hooker found the temperature of the soil at 107° Fahr. a few feet below the surface. In the hotter seasons of the year, the sun, even in the early morning, is overpowering, and above the rocks the air flickers from the intense heat, while all distant objects are disturbed by an imperfect mirage."<sup>2</sup>

<sup>1</sup>Hist. Gen. des Voyages, XXXI, 426.

<sup>2</sup>Anderson, *Florula Adenensis*, p. vi-vii.

The differences in temperature in different parts of the peninsula are considerable. In July and August, according to Haines, "within the town of Aden the thermometer varies from  $84^{\circ}$  at sunrise to  $104^{\circ}$  with the sun past the meridian, during the westerly winds, while at the W. point, forming the entrance to the harbour, the thermometer varies from  $74^{\circ}$  to  $88^{\circ}$  at the same period. This difference is caused by the winds crossing the high mountain before it reaches the town of Aden, whereas at the W. point it meets with no obstruction." <sup>1</sup>

The following thermometrical readings confirm the above statements. They give the average temperature during the year at the three military positions : Camp, Isthmus, and Steamer Point, as given by Hunter, l. c.

### Camp.

Months.	1873-74.			1874-75.			1875-1876.		
	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.
April . . .	88	82	85	92	81	86.5	86	77	81.5
May . . .	91	86	88.5	97	86	91.5	90	80	85
June . . .	95	90	92.5	102	89	95.5	94	84	89
July . . .	97	90	93.5	100	80	90	96	86	91
August . . .	96	90	93	95	75	85	94	84	89
September . . .	93	88	90.5	95	84	89.5	91	81	86
October . . .	89	84	86.5	92	73	82.5	87	78	82.5
November . . .	85	84	84.5	85	70	77.5	85	76	80.5
December . . .	81	79	80	84	67	75.5	82	72	77
January . . .	80	77	78.5	84	66	75	78	71	74.5
February . . .	83	79	81	82	71	76.5	78	72	75
March . . .	84	81	82.5	86	75	80.5	82	79	80.5
Average . . .	88.5	84.1	86.3	91.1	76.5	83.8	86.9	78.3	82.6

<sup>1</sup> Haines, S. B.: Memoir of the South and East Coasts of Arabia. In Journ. Roy. Geogr. Soc., Vol. 15 (1845), 104-160.

Isthmus.

Months.	1873-74.			1874-75.			1875-76.		
	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.
April . . .	97	82	89.5	89	79	84	86	83	84.5
May . . .	88	84	86	96	83	89.5	90	87	88.5
June . . .	93	87	90	101	86	93.5	93	89	91
July . . .	93	88	90.5	99	83	91	93	88	90.5
August . . .	93	87	90	97	82	89.5	92	86	89
September . . .	90	85	87.5	98	84	91	90	87	88.5
October . . .	85	80	82.5	92	77	84.5	86	77	81.5
November . . .	81	78	79.5	85	73	79	81	78	79.5
December . . .	79	76	77.5	81	72	76.5	78	76	77
January . . .	78	75	76.5	80	71	75.5	78	76	77
February . . .	80	77	78.5	80	74	77	77	74	75.5
March . . .	82	79	80.5	87	79	83	81	80	80.5
Average . . .	86.5	81.5	84	90.4	78.5	84.5	85.4	82.5	83.4

Steamer Point.

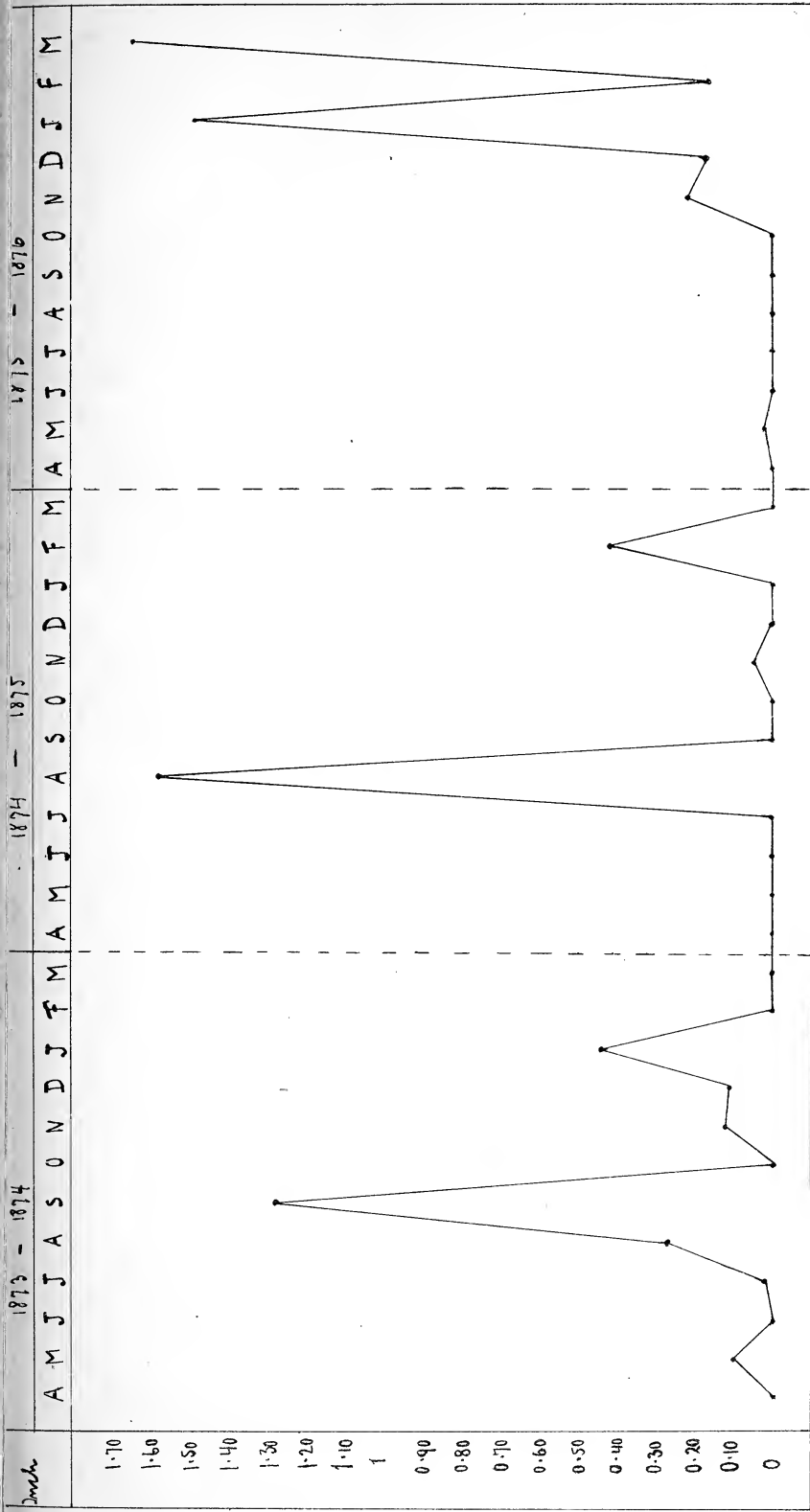
Months.	1873-74.			1874-75.			1875-76.		
	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.	Maxi- mum.	Mini- mum.	Mean.
April . . .	90	79	84.5	88	78	83	90	80	85
May . . .	91	83	87	93	85	89	92	83	87.5
June . . .	93	84	88.5	95	84	89.5	93	86	89.5
July . . .	92	84	88	92	82	87	90	81	87
August . . .	92	85	88.5	88	80	84	90	82	86
September . . .	91	84	87.5	93	84	88.5	93	85	89
October . . .	88	77	82.5	89	78	83.5	89	79	84
November . . .	84	76	80	84	74	79	86	74	80
December . . .	81	74	77.5	82	72	77	82	73	77.5
January . . .	80	74	77	80	70	75	81	75	78
February . . .	82	75	78.5	81	70	77.5	81	75	78
March . . .	86	77	81.5	86	76	81	84	77	80.5
Average . . .	87.5	79.3	83.4	87.6	77.7	82.6	87.8	79.4	83.5

The average temperature at Steamer Point during the last five years was:—<sup>1</sup>

Average.	1907.	1908.	1909.	1910.	1911.
Maximum . . .	89·4	88·1	87·7	88·3	88·7
Minimum . . .	78·6	77·4	78·8	78·4	79·5
Mean . . . .	84	82·7	83·3	83·3	84·1

We add the graphic representation of the readings as given above for the years 1873-76, and the graphic representation of monthly rainfall at the Civil Hospital in the crater for April 1873 to March 1876.

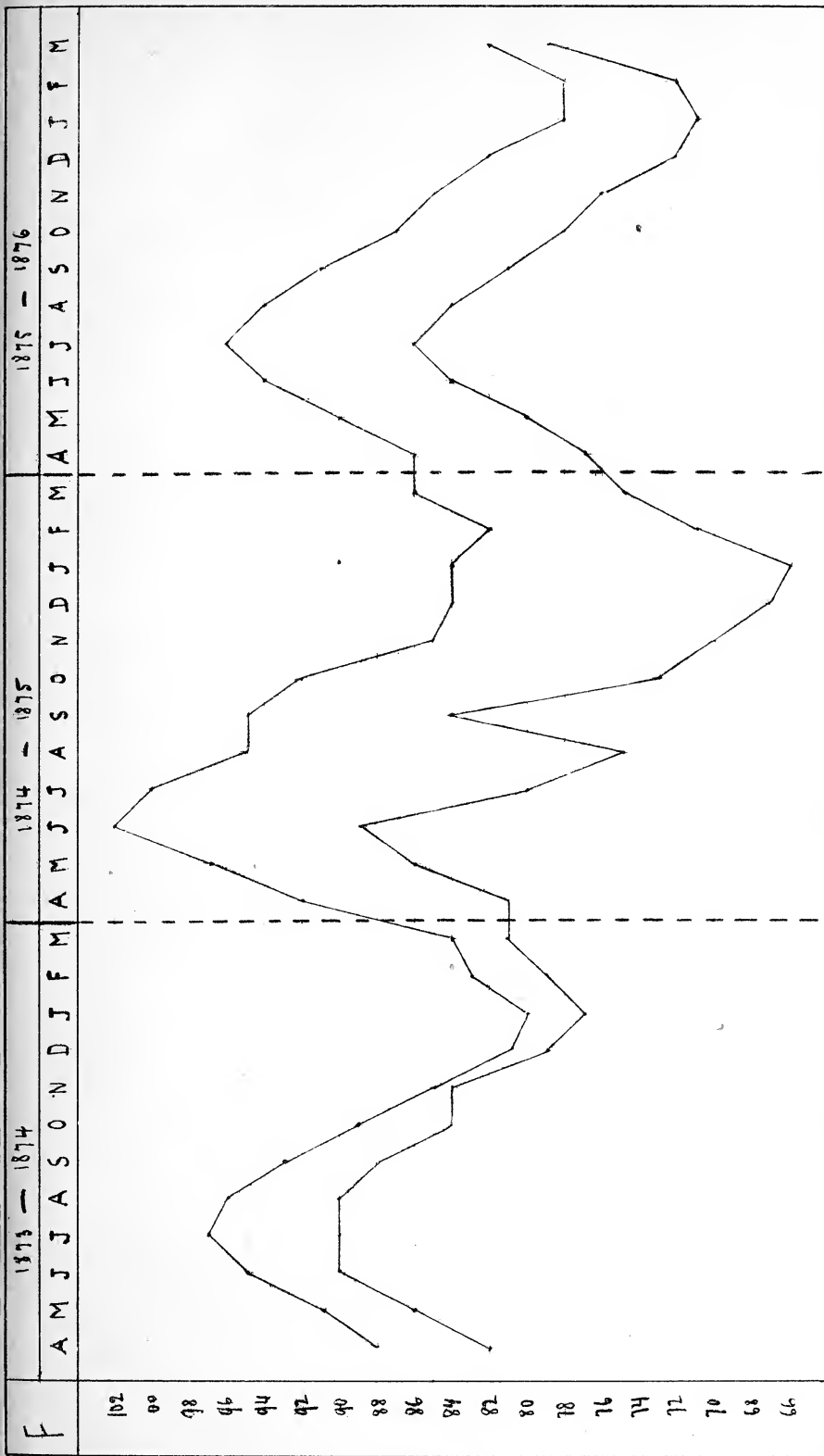
<sup>1</sup> S. E. Prall, in epist.



Monthly Rainfall registered at the Civil Hospital in the Canton from April 1873 to March 1876  
 (A, M, etc. = April, May, etc.).

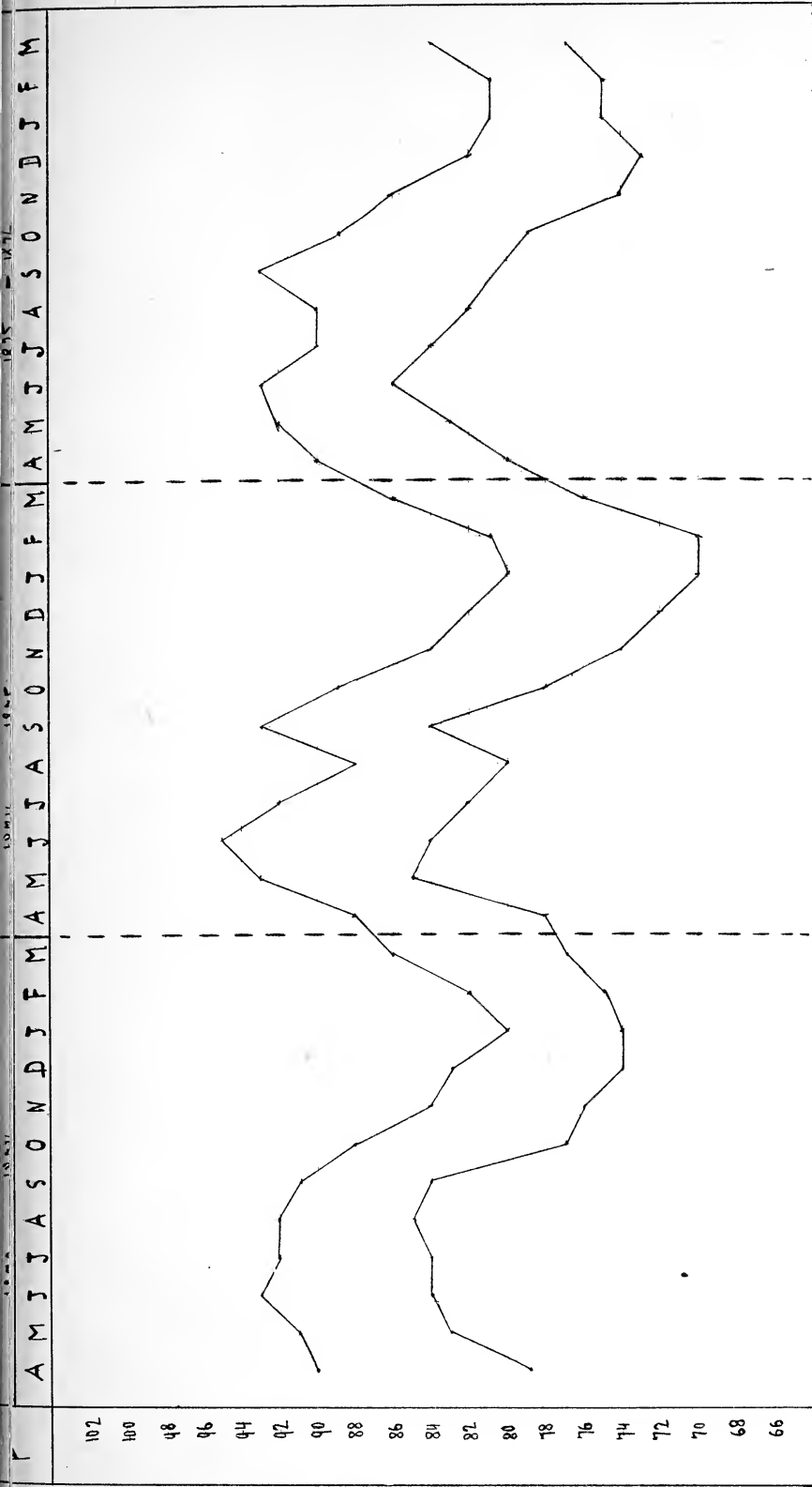






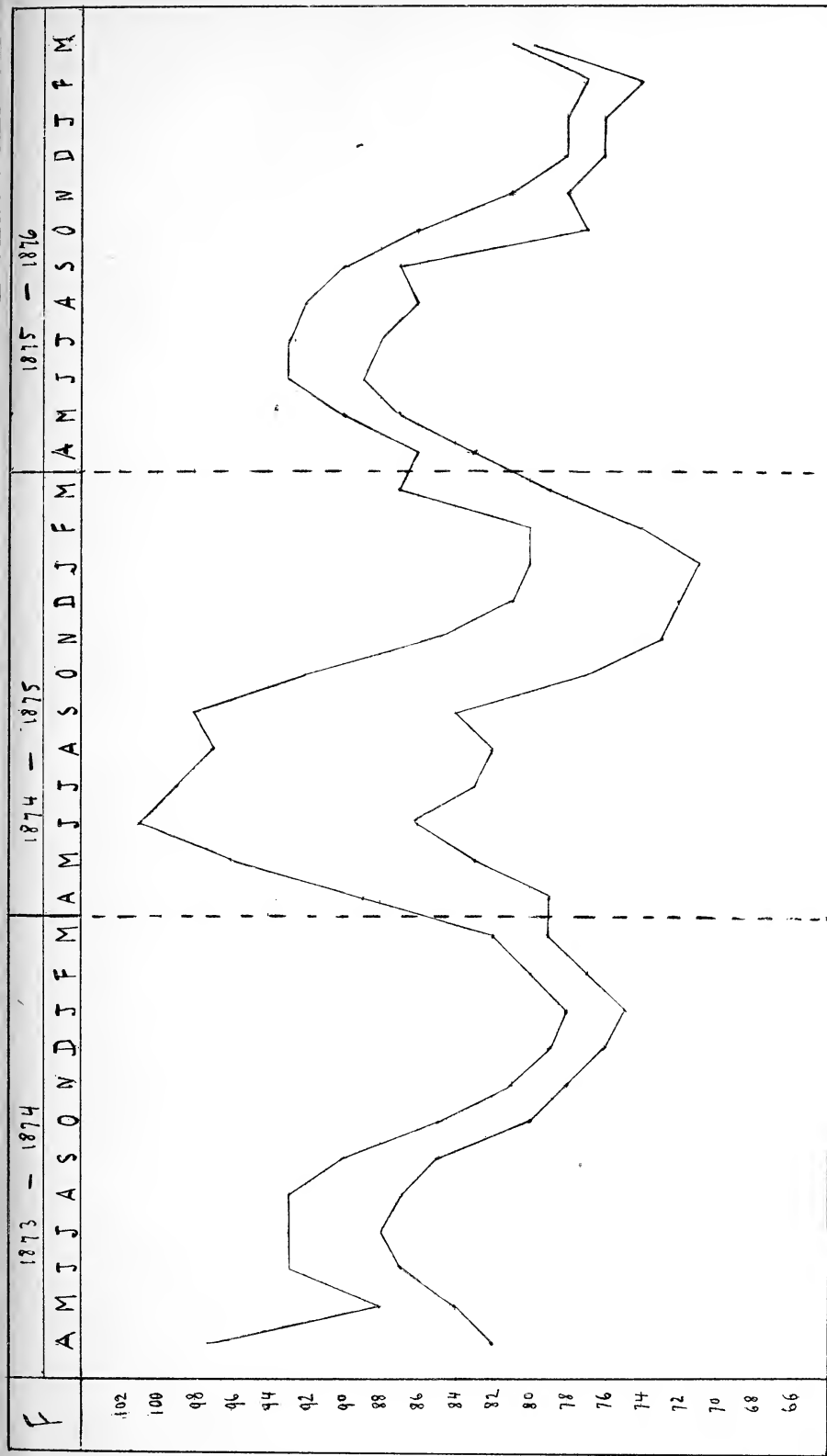
Mean Minimum and Minimum of Temperature observed in the Camp from April 1873 to March 1876. (A M etc. = April May, etc.).





Mean Maximum and Minimum of temperature observed at Steamer Point from April 1873 to March 1876.  
 (A, M, etc. = April, May, etc.).





Mean Maximum and Minimum of temperature observed on the Tethys from April 1873 to March 1876,  
 (A, M etc. = April, May, etc.)



### III.—THE VEGETATION.

1. **Statistical Account.** Ibn Batuta who travelled in Arabia between 1328 and 1330 paid also a visit to Aden. He writes :

"I left the town of Aden, the port of the country of Yemen, which is situated on the coast of the Great Ocean. It is surrounded by mountains and it is accessible on one side only. It is a large town, but there are neither seeds nor trees nor water. There are only tanks which receive the rainwater, but fresh water is to be found a great distance from the town." <sup>1</sup>

Aden is, however, not so entirely destitute of vegetation as might be inferred from this description of the famous traveller. Many of the valleys are thickly studded with small trees and shrubs, producing beautiful flowers, and it is no uncommon circumstance for the inhabitants of Shaikh Othman to send their goats and camels to find pasturage amongst the valleys on the west side of the peninsula, when none is procurable in their own district. <sup>2</sup>

We must, nevertheless, call the flora of Aden a very poor one if we compare the total of species with the comparatively considerable area they occupy. We shall describe 250 indigenous species which represent 55 orders and 138 genera.

The accompanying table will give an idea of the small proportion of species to the number of genera and natural orders :

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Ibn Batuta Trad. de MM. Defrémery et Sanguinetti, vol. II, p. 177.

<sup>2</sup> Playfair, R. L. A History of Arabia Felix or Yemen. Select. from the Rec. of the Bombay Government, 1859, p. 6.

Order.		Genera.	Species.	Order.		Genera.	Species.
1.	Menispermaceæ . .	1	1	29.	Asclepiadaceæ . .	7	8
2.	Cruciferae . .	2	2	30.	Boraginaceæ . .	3	11
3.	Capparidaceæ . .	5	18	31.	Convolvulaceæ . .	3	5
4.	Resedaceæ . .	2	2	32.	Solanaceæ . .	1	1
5.	Polygalaceæ . .	1	3	33.	Scrophulariaceæ . .	5	9
6.	Caryophyllaceæ . .	3	5	34.	Orobanchaceæ . .	1	1
7.	Portulacaceæ . .	1	1	35.	Bignoniaceæ . .	1	1
8.	Malvaceæ . .	2	3	36.	Acanthaceæ . .	3	3
9.	Sterculiaceæ . .	2	2	37.	Verbenaceæ . .	1	2
10.	Tiliaceæ . .	2	4	38.	Labiatae . .	3	3
11.	Zygophyllaceæ . .	3	5	39.	Nyctaginaceæ . .	1	3
12.	Geraniaceæ . .	1	1	40.	Illecebraceæ . .	1	2
13.	Burseraceæ . .	1	2	41.	Amarantaceæ . .	4	6
14.	Rhamnaceæ . .	1	2	42.	Chenopodiaceæ . .	7	11
15.	Vitaceæ . .	1	1	43.	Aristolochiaceæ . .	1	1
16.	Moringaceæ . .	1	1	44.	Loranthaceæ . .	1	1
17.	Leguminosæ . .	10	32	45.	Euphorbiaceæ . .	4	13
18.	Combretaceæ . .	1	1	46.	Urticaceæ . .	1	2
19.	Lythraceæ . .	1	1	47.	Hydrocharidaceæ . .	1	1
20.	Loasaceæ . .	1	1	48.	Amaryllidaceæ . .	1	2
21.	Cucurbitaceæ . .	3	6	49.	Liliaceæ . .	3	3
22.	Ficoideæ . .	4	6	50.	Commelinaceæ . .	1	1
23.	Umbelliferae . .	1	1	51.	Palmæ . .	1	1
24.	Rubiaceæ . .	1	2	52.	Naiadaceæ . .	1	3
25.	Compositæ . .	8	10	53.	Cyperaceæ . .	1	3
26.	Plumbaginaceæ . .	1	2	54.	Gramineæ . .	17	33
27.	Salvadoraceæ . .	2	3	55.	Gnetaceæ . .	1	1
28.	Apocynaceæ . .	1	1				

This list shows that there exists a great preponderance of natural orders and genera if compared with the number of species. The proportion of orders, genera, and species is 1 : 2·5 : 4·5, whilst on the



neighbouring Socotra the vegetation shows the following proportion :  
1 : 4 : 7.

This seems to indicate that the paucity of species in the flora of Aden is not the result of situation or isolation, but the necessary consequence of the meteorological factors combined with unfavourable edaphic conditions. The vegetation has to strive against conditions tending to the entire extinction of vegetable life, *viz.* excessive heat and drought. It is probably owing to this fact that no less than 19 orders are represented by only one species, 11 by 2, and 9 by 3.

Of the 250 species 47 are Monocotyledons, the majority, *viz.*, 33, belonging to the *Gramineae*. Of Dicotyledons there are 202 species, *i.e.*, about  $\frac{4}{5}$  of the whole flora. The predominant orders are the *Leguminosae* with 32 species, the *Capparidaceae* with 18, the *Euphorbiaceae* with 13, the *Boraginaceae* and *Chenopodiaceae* with 11, the *Compositae* with 10, and the *Scrophulariaceae* with 9. The flora is composed of 136 herbs, 46 undershrubs, 58 shrubs, and 10 trees. We give in the following a complete list of all the species reported from Aden, indigenous as well as introduced. The names printed in italics indicate that the respective species is not indigenous in Aden. The record of the plants observed in Little Aden is very incomplete. Defflers says that most plants growing in Aden occur likewise in Little Aden.

Explanation of abbreviations :

A. = Arbor, tree.

F. = Frutex, shrub.

S. = Suffrutex, undershrub.

H. = Herba, herb.

a. = annual.

p. = perennial.

b = biennial.

Order.	Genus.	Species.	End	Indi.	Introd.	Aden.	Little A.	Sh. Oth.	—
Menispermaceae	Cocculus	cebatha DC.	...	x	...	x	...	...	F.
Cruciferae	Farsetia	longisiliqua Dene.	...	x	...	x	...	...	S.
	Diplotaxis	pendula DC.	...	x	...	x	...	...	H.
Capparidaceae	Cleome	quinquenervia DC.	...	x	...	x	...	...	S.
		papillosa Steud.	...	x	...	x	...	...	H. p.
		brachycarpa Vahl	...	x	...	x	...	...	H. p.
		paradoxa R. Br.	...	x	...	x	...	...	S.
		pruinosa Anders.	x	...	...	x	...	...	S.
		brachystyla Defl.	...	x	...	x	...	...	S.

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Sh. Othman.	—
		<i>polytricha</i> Franch.	...	x	...	x	...	..	S.
		<i>droserifolia</i> Del.	...	x	...	x	..	...	S.
	<i>Dipterygium</i>	<i>glaucum</i> Dene.	...	x	...	x	...	x	S.
	<i>Mærua</i>	<i>Thomsoni</i> Anders.	...	x	..	x	...	..	F.
		<i>crassifolia</i> Forsk.	...	x	...	x	x	...	F.
		<i>ovalifolia</i> Cambess.	...	x	...	x	...	...	F.
	<i>Cadaba</i>	<i>rotundifolia</i> Forsk.	...	x	...	x	...	x	F.
		<i>glandulosa</i> Forsk.	...	x	...	x	...	...	F.
		<i>longifolia</i> DC.	...	x	...	x	..	...	F.
		<i>farinosa</i> Forsk.	...	x	...	x	...	...	F-A
	<i>Capparis</i>	<i>galeata</i> Fresen.	...	x	...	x	...	...	F.
		<i>decidua</i> Pax	...	x	...	x	...	...	F.
Resedaceæ	<i>Reseda</i>	<i>amblyocarpa</i> Fresen.	...	x	...	x	...	...	H. p.
	<i>Ochradenus</i>	<i>baccatus</i> Del.	...	x	...	x	...	...	H. p.
Polygalaceæ	<i>Polygala</i>	<i>eriotpera</i> DC.	...	x	...	x	...	...	H. a.
		<i>Thurmanniana</i> Chod.	...	x	...	x	...	...	H. p.
		<i>chinensis</i> Linn.	...	x	...	x	...	...	H. a.
Caryophyllaceæ	<i>Polycarpæa</i>	<i>corymbosa</i> Lam.	...	x	...	x	...	...	H. a.
		<i>spicata</i> Wight	...	x	...	x	...	...	H.
		<i>fragilis</i> Del.	...	x	...	x	...	...	H.
	<i>Sphærocoma</i>	<i>Hookeri</i> Anders.	...	x	...	x	...	...	F.
	<i>Gypsophila</i>	<i>montana</i> Balf. <i>var. diffusa</i> Balf.	...	x	...	x	...	...	H. p.
Portulacaceæ	<i>Portulaca</i>	<i>quadrifida</i> Linn.	...	x	...	x	...	...	H. a.
Malvaceæ	<i>Abutilon</i>	<i>fruticosum</i> Guill. et Perr.	...	x	...	x	...	...	S.
	<i>Hibiscus</i>	<i>micranthus</i> Linn.	...	x	...	x	...	...	S.
		<i>Welshii</i> Anders.	...	x	...	x	...	...	S.
	<i>Thespesia</i>	<i>populnea</i> Correa	...	...	x	x	...	...	A.
Sterculiaceæ	<i>Sterculia</i>	<i>arabica</i> Anders.	...	x	...	x	...	...	A.
	<i>Melbania</i>	<i>Denhamii</i> R. Br.	...	x	...	x	...	...	F.
Tiliaceæ	<i>Grewia</i>	<i>populifolia</i> Vahl	...	x	...	x	...	...	F.
	<i>Corchorus</i>	<i>antichorus</i> Ræuschel	...	x	...	x	...	...	S.

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Sh. Odlman.	—
Zygophyllaceæ	Tribulus	trilocularis Linn.	...	x	...	x	...	...	H. a.
		olitorius Linn.	...	x	...	x	...	...	H. a.
		terrestris Linn.	...	x	...	x	...	...	H. a.
		Zygophyllum simplex Linn.	...	x	...	x	...	...	H
		Fagonia cretica Linn.	...	x	...	x	...	...	H. a.
Geraniaceæ	Erodium	parviflora Boiss. var. brevispina Schw.	...	x	...	x	...	...	F.
		glabra Krause	x	...	...	x	...	...	H. p.
		malacoides Willd.	...	x	...	x	...	...	H. a.
Meliaceæ	Melia	Azedarach Linn.	...	...	x	...	...	x	A.
	Azadirachta	indica A. Juss.	...	...	x	...	...	x	A.
Burseraceæ	Commipohra	abyssinica Engl. var. simplicifolia Schweinf.	...	x	...	x	...	...	F.
		opobalsamum Engl. var. gileadense Engl.	...	x	...	x	x	...	F.-A.
	Boswellia	Carterii Birdw.	...	...	x	x	...	...	A.
Rhamnaceæ	Zizyphus	spina Christi Willd.	...	x	...	x	...	...	A.
		lotus Lam.	...	x	...	x	...	...	A.
Vitaceæ	Vitis	quadrangularis Wall.	...	x	...	x	...	...	F.
Moringaceæ	Moringa	aptera Gaertn.	...	x	...	x	...	...	A.
Leguminosæ	Crotalaria	lupinoides Hochst.	...	x	...	x	...	...	S.
		leptocarpa Balf.	...	x	...	x	x	...	H.
		Schweinfurthii Deß.	x	...	...	x	...	...	S.
		striata DC.	...	x	...	x	...	...	H.-S.
		falcata Vahl	...	x	...	x	...	...	S.
		Argyrolobium arabicum Jaub. & Spach.	...	x	...	x	...	...	S.
	Medicago	roseum Jaub. & Spach.	...	x	...	x	...	...	H. a.
		sativa Linn.	...	...	x	...	...	x	H.
	Indigofera	paucifolia Del.	...	x	...	x	x	...	F.
		parvula Del.	...	x	...	x	...	...	S.
		semitrijuga Forsk.	...	x	...	x	x	...	S.
		arabica Jaub. & Spach.	...	x	...	x	...	...	S.

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	S-h. Othman.	
		<i>argentea</i> Linn. . .	...	x	...	x	...	...	F.
		<i>leptocarpa</i> Hochst. & Steud. . .	...	x	...	...	x	...	H.
		<i>trigonelloides</i> Jaub. & Spach. . .	...	x	...	x	...	...	H. a.
	<i>Tephrosia</i>	<i>apollitea</i> Link. . .	...	x	...	x	...	x	S.
		<i>pogonostigma</i> Boiss. . .	...	x	...	x	...	...	S.
	<i>Sesbania</i>	<i>grandiflora</i> Pers. . .	...	...	x	...	...	x	A.
	<i>Taverniera</i>	<i>glaucæ</i> Edgew. . .	...	x	..	x	...	...	F.
		<i>Schimperi</i> Jaub. & Spach. . .	...	x	...	x	...	...	F.
	<i>Alhagi</i>	<i>maurorum</i> Medic. . .	...	x	...	x	...	...	F.
	<i>Rhynchosia</i>	<i>memnonia</i> DC. . .	...	x	...	x	x	...	H. a.
	<i>Poinciana</i>	<i>elata</i> Linn. . .	...	x	...	x	...	...	A.
	<i>Cassia</i>	<i>obovata</i> Collad. . .	...	x	...	x	...	...	H p.
		<i>holosericea</i> Fresen. . .	...	x	...	x	...	...	S.
		<i>angustifolia</i> Vahl . . .	...	x	...	x	...	...	F.
		<i>adenensis</i> Benth. . .	...	x	...	x	...	..	S.
		<i>auriculata</i> Linn. . .	...	...	x	...	...	...	F.
	<i>Parkinsonia</i>	<i>aculeata</i> Linn. . .	...	...	x	...	...	x	F.-A.
	<i>Casalpinia</i>	<i>pulcherrima</i> Sw. . .	...	..	x	x	...	...	F.-A.
	<i>Acacia</i>	<i>eburnea</i> Willd. . .	..	x	...	x	...	...	F.-A.
		<i>Edgeworthii</i> Anders. . .	...	x	...	x	...	...	F.
		<i>hamulosa</i> Benth. . .	...	x	...	x	...	...	F.
		<i>spirocarpa</i> Hochst . . .	...	x	...	x	...	x	A.
		<i>nubica</i> Benth. . .	...	x	...	x	...	...	F.
		<i>mellifera</i> A. Rich. . .	...	x	...	x	...	...	F.-A.
		<i>laeta</i> Dcfl. . .	...	x	...	x	...	...	A.
		<i>arabica</i> Willd. . .	...	...	x	x	..	...	A.
		<i>Farnesiana</i> Willd. . .	...	...	x	...	...	x	F.-A.
	<i>Prosopis</i>	<i>juliflora</i> DC . . .	...	...	x	x	...	...	F.-A.
	<i>Calliandra</i>	<i>umbrosa</i> Benth. . .	...	...	x	...	..	x	A.

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Sh. Othman.	—
Combretaceæ	Terminalia	sp. . . . .	...	x	...	x	...	...	A.
Lythraceæ	Lawsonia	inermis Linn. .	...	x	...	...	...	x	F.
Loasaceæ	Kissenia	spathulata R. Br. .	...	x	...	x	...	...	F.
Cucurbitaceæ	Cucumis	prophetarum Linn. .	...	x	...	x	...	...	H. a.
		pustulatus Hook. .	..	x	...	x	...	...	H. p.
	Citrullus	colocynthis Schrad. .	...	x	...	x	..	...	H. p.
	Corallocarpus	glomeruliflorus Schweinf. . .	...	x	...	x	x	...	S.
		erostrius Oliv. . .	...	x	...	x	..	...	H.
		velutinus Benth. & Hook. f. . . . .	...	x	...	x	...	...	H.
			...	x	...	x	...	...	H.
Ficoideæ	Trianthema	crystallina Vahl . .	...	x	...	x	...	...	H. a.-p.
		pentandra Linn. . .	...	x	...	x	...	...	H.
		monogyna Linn. . .	...	x	...	...	...	x	H.
	Orygia	decumbens Forsk. .	...	x	...	x	...	...	H.
	Mollugo	Cerviana Seringe .	...	x	...	x	...	...	H. a.
	Linum	indicum Stocks. .	...	x	...	x	...	...	H. p.
Umbelliferae	Ptychotis	arabica Anders. .	...	x	...	x	...	...	H.
Rubiaceæ	Oldenlandia	Schimperi Anders. .	...	x	...	x	...	...	H. a.-p.
		stricta Linn. . .	...	x	...	x	...	...	H. a.-p.
Compositae	Vernonia	atriplicifolia J. & Sp. .	...	x	...	x	...	...	F.
	Pluchea	indica Less. . .	...	x	...	x	...	...	F.
	Iphiona	scabra Dene. . .	...	x	...	x	...	...	F.
	Pegolettia	senegalensis Cass. .	...	x	...	x	...	...	H. a.
	Pulicaria	glutinosa Jaub. & Spach. .	...	x	...	x	...	...	F.
		Adenensis Schweinf. .	x	...	...	x	...	...	S.
	Dicoma	Schimperi O. Hoffm. .	...	x	...	x	...	...	H. p.
	Lactuca	goraeensis Schultz .	...	x	...	x	...	...	H. a.-b.
	Launsea	lactucoides O. Hoffm. .	...	x	...	x	...	...	H. a.
		nudicaulis Less. .	...	x	...	x	...	...	H. p.

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Sh. Oman.	—	
Plumbaginaceæ	Statice .	axillaris Forsk. . .	...	x	...	x	...	...	F.	
		cylindrifolia Forsk. .	...	x	...	x	...	...	S.	
Salvadoraceæ .	Salvadora .	persica Linn. . .	...	x	...	x	...	...	F.-A.	
		oleoides Dene. .	...	x	...	x	...	...	F.-A.	
Apocynaceæ .	Dobera . .	glabra DC. . .	...	x	...	...	x	...	A.	
		arabicum Balf. f. .	...	x	...	x	...	...	F.	
Asclepiadaceæ .	Glossonema .	Boveanum Dene. .	...	x	...	x	x	...	H.	
		Calotropis .	...	x	...	x	...	x	F.	
		Pentatropis .	...	x	...	...	...	x	H.	
		Steinheilii .	...	x	...	x	...	...	H. p.	
		Dæmia . .	...	x	...	x	x	...	H.	
		Caralluma .	...	x	...	x	...	...	H. p.	
		Forskalii K. Schum. .	...	x	...	x	...	...	H. p.	
		Kanahia . .	...	x	...	x <sup>p</sup>	...	...	F.	
		Heliotropium .	strigosum Willd. .	...	x	...	x	...	...	H. p.
			zeylanicum Lam. .	...	x	...	x	...	...	H. a.
pterocarpum Hochst. & Steud. .	...		x	...	x	...	x	H. a.		
ophioglossum Stocks .	...		x	...	x	...	...	S.		
lignosum Vatke . .	...		x	...	x	...	...	S.		
adenense Guerke . .	...		x	...	x	...	...	H. p.		
undulatum Vahl . .	...		x	...	x	...	...	H. p.		
paradoxum Vatke .	...		x	...	...	...	x	H. p.		
Arnebia . .	...		x	...	x	...	...	H. a. b		
Echiochilon .	...		x	...	x	...	...	H. p.		
Convolvulaceæ .	Convolvulus .	longiflorum Benth. .	...	x	...	x	...	...	H. p.	
		glomeratus Chois. .	...	x	...	x	...	...	H. p.	
	Breweria .	sericophyllus Anders. .	...	x	...	x	...	...	H. p.	
		latifolia Benth. et Hook. .	...	x	...	x	...	...	S.	
		Ipomœa . .	biloba Forsk. .	...	x	...	x	...	x	H.
		calycina C. B. Clarke .	...	x	...	x	...	...	H.	

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Sh. Oman.	—
Solanaceæ	Lycium .	europæum Linn. .	...	x	...	x	...	...	F.
	Capsicum .	annuum Linn. .	...	...	x	x	...	...	H. a.
Scrophulariaceæ	Linaria .	macilentia Dene. .	...	x	...	x	...	...	S.
		sagittata Hook. f. .	...	x	...	x	...	...	H. p.
	Schweinfurh	pedicellata Benth. et H. .	...	x	...	x	...	...	H. p.
		pterosperma, A. Br. .	...	x	...	x	...	...	H. a.
	Anticharis .	glandulosa Aschers. .	...	x	...	x	...	...	H.
		arabica Endl. .	...	x	...	x	...	...	H. a.
		linearis Hochst. .	...	x	...	x	...	...	H. a.
	Lindenbergia .	sinaica Benth. .	...	x	...	x	...	...	S.
Orobanchaceæ	Campylanthus	juncus Edgew. .	...	x	...	x	...	...	S.
	Cistanche .	lutea Hoffm. & Lk. .	...	x	...	x	...	...	H.
Bignoniaceæ	Tecoma .	sp. . . . .	...		x	...	...	x	F.
Acanthaceæ	Blepharis .	edulis Pers. .	...	x	...	x	...	...	S.
	Ruellia .	patula Jacq. .	...	x	...	x	...	...	F.
	Barleria .	Hildebrandtii S. Moore .	...	x	...	x	...	...	S.
Verbenaceæ	Bouchea .	marrubifolia Schauer .	...	x	...	x	...	...	H. p.
		pterygocarpa Schauer .	...	x	...	x	...	...	H. p.
Labiate .	Ocimum .	suave Willd. .	...	x	...	x	...	...	H.
	Orthosiphon	pallidus Royle .	...	x	...	x	...	...	S.
	Lavandula .	setifera Anders. .	...	x	...	x	...	...	H.
Nyctaginaceæ	Boerhaavia .	verticillata Poir. .	...	x	...	x	...	...	H.
		elegans Chois. .	...	x	...	x	...	...	H. p.
		repens Linn. .	...	x	...	...	...	x	H.
Illecebraceæ	Cometes .	abyssinica R. Br. .	...	x	...	x	...	...	H. p.
		surattensis Burm. .	...	x	...	x	...	...	H. p.
Amarantaceæ	Amarantus	viridis Linn. .	...	x	...	x	...	...	H. a.
		polygamus Linn. .	...	x	...	x	...	...	H. a.
	Saltia .	papposa Moq. .	...	x	...	x	...	...	F.
	Ærua .	tomentosa Forsk. .	...	x	...	x	...	...	S.
		lanata Jus. .	...	x	...	x	...	...	S.

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Su. Othman.	—
Chenopodiaceæ	Celosia	argentea Linn.	...	x	...	...	...	x	H. a.
	Atriplex	farinosa Forsk.	...	x	...	...	x	...	S.
	Halopeplis	perfoliata Bunge	...	x	...	x	...	...	F.
	Suaeda	monoica Forsk.	...	x	...	x	...	x	F.
		vermiculata Forsk.	...	x	...	x	...	...	F.
		baccata Forsk.	...	x	...	x	...	x	S.
		fruticosa Forsk.	...	x	...	x	...	...	F.
	Traganum	nudatum Del.	...	x	...	x	...	...	S.
	Salsola	Bottæ Boiss.	...	x	...	x	...	...	F.
		Forskalii Schweinf.	...	x	...	x	...	...	F.
	Anabasis	Ehrenbergii Schweinf.	...	x	...	x	...	...	S.
	Cornuluca	monacantha Del.	...	x	...	x	...	...	S.
Aristolochiaceæ	Aristolochia	bracteata Retz.	...	x	...	x	...	...	H. p.
Loranthaceæ	Loranthus	curviflorus Benth.	...	x	...	...	...	...	F.
Euphorbiaceæ	Euphorbia	hypericifolia Linn.	...	x	...	x	...	...	H. a.
		arabica Hochst. & St.	...	x	...	x	...	...	S.
		granulata Forsk.	...	x	...	x	x	...	H. p.
		polycnemoides Hochst.	...	x	...	x	...	...	H.
		Bottæ Boiss.	...	x	...	x	...	...	S.
		Schimperi Presl.	...	x	...	x	...	...	F.
		cuneata Vahl	...	x	...	x	...	...	F.
		systyla Edgew.	...	x	...	x	...	...	S.
		adenensis Deff.	...	x	...	x	...	...	F.
	Phyllanthus	maderaspatensis Linn.	...	x	...	x	...	...	H. a.
	Jatropha	spinosa Vahl	...	x	...	x	...	...	H. a.
		var. genuina Pax	...	x	...	x	...	...	F.
		var. crenulata Pax	...	x	...	x	...	...	F.
		lobata Müll.	...	x	...	x	...	...	F.
	Chrozophora	obliqua Juss.	...	x	...	x	...	...	H.
	Ricinus	communis Linn.	...	...	x	...	...	x	...
Urticaceæ	Forskohlea	tenacissima Linn.	...	x	...	x	...	...	S.



Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Sh. Othman.	—
		<i>viridis</i> Ehrbg. . .	..	x	...	x	...	...	H. a.
Hydrocharitaceæ	<i>Halophila</i>	<i>ovata</i> Gaudich . .	...	x	...	x	...	...	H. p.
Scitamineæ	<i>Musa</i>	<i>paradisiaca</i> Linn. .	...	...	x	...	...	x	...
Amaryllidaceæ	<i>Pancratium</i>	<i>tortuosum</i> Herb. . .	...	x	...	x	...	...	H. p.
		<i>maximum</i> Forsk. . .	...	x	...	x	...	...	H. p.
	<i>Polianthes</i>	<i>tuberosa</i> Linn. . .	...	...	x	...	...	x	H. p.
Liliaceæ	<i>Albuca</i>	<i>Yerburyi</i> Ridley . .	x	...	...	x	...	...	H. p.
	<i>Littonia</i>	<i>minor</i> Deff. . . .	...	x	...	...	x	...	H. p.
	<i>Dipcadi</i>	<i>erythræum</i> Webb. & B.	...	x	...	...	x	...	H. p.
Commelinaceæ	<i>Commelina</i>	<i>albescens</i> Hassak . .	...	x	...	x	...	...	H
Palmeæ	<i>Hyphæne</i>	<i>thebaica</i> Mart. . .	...	x	...	...	...	x	A
	<i>Phoenix</i>	<i>dactylifera</i> Linn. .	...	...	x	x	...	x	A
Naiadaceæ	<i>Cymodocea</i>	<i>ciliata</i> Ehrbg. . . .	...	x	...	x	...	...	H. p.
		<i>serrulata</i> Aschers. .	...	x	...	x	...	...	H. p.
		<i>isoëtifolia</i> Aschers. .	...	x	...	x	...	...	H. p.
Cyperaceæ	<i>Cyperus</i>	<i>conglomeratus</i> Rottb. .	...	x	...	x	...	...	H. p.
		<i>effusus</i> Rottb. . . .	...	x	...	x	...	...	H. p.
		<i>cruentus</i> Rottb. . . .	...	x	...	x	...	...	H. p.
Gramineæ	<i>Andropogon</i>	<i>foveolatus</i> Del. . . .	...	x	...	x	...	...	H.
		<i>Iwarancusa</i> Jones . .	...	x	...	...	x	...	H. p.
		<i>sorghum</i> Brot. . . .	...	...	x	...	...	x	H. a.
		<i>var. bicolor</i> Hack. . .	...	...	x	...	...	x	H. a.
	<i>Saccharum</i>	<i>spontaneum</i> Linn. . .	...	...	x	...	...	x	H. a.
	<i>Zea</i>	<i>Mays</i> Linn. . . . .	...	...	...	...	...	...	H. a.
	<i>Pennisetum</i>	<i>cenchræoides</i> A. Rich. .	...	x	...	x	...	...	H. p.
	<i>Setaria</i>	<i>viridis</i> Beauv. . . .	...	x	...	x	...	...	H. a.
		<i>verticillata</i> Beauv. . .	...	x	...	x	...	...	H. a.
	<i>Tricholæna</i>	<i>teneræ</i> Parl. . . . .	...	x	...	x	...	...	H. p.
	<i>Panicum</i>	<i>leucanthum</i> A. Rich. .	...	x	...	x	...	...	H.
		<i>colonum</i> Linn. . . . .	...	x	...	...	...	...	H. a.

Order.	Genus.	Species.	Endemic.	Indig.	Introd.	Aden.	Little A.	Sp. Odman.	
		turgidum Forsk. . .	...	x	...	...	x	...	H. p.
		antidotale . . .	...	x	...	...	...	x	H. p.
		Leersioides Hochst. . .	...	x	...	x	...	...	H. a(?)
	Digitaria . .	pennata T. Cooke . .	...	x	...	x	...	...	H
	Eriochloa . .	polystachya H.B. and K. . .	...	x	...	...	...	x	H. p.
	Aristida . .	adscensionis Linn. . .	...	x	...	x	...	...	H. a. p.
		pumila Dene. . .	...	x	...	x	x	...	H. a.
		brachypoda Tausch . .	...	x	...	...	...	...	H
		paradisea Edgew. . .	...	x	...	x	...	...	H
		hirtigluma Steud . .	...	x	...	x	...	...	H. p.
		plumosa Linn. . .	...	x	...	x	...	...	H. p.
		mutabilis Trin. and Rupr. . .	...	x	...	x	...	...	H
	Sporobolus . .	glaucofolius Hochst. . .	...	x	...	x	...	...	H. p.
		spicatus Kunth . .	...	x	...	...	...	x	H. p.
		robustus Kunth . .	...	x	...	x	...	...	H. p.
	Eragrostis . .	ciliaris Link . .	...	x	...	x	...	...	H.
		major Host. . .	...	x	...	x	...	...	H. a.
	Desmostachya . .	bipinnata Stapf . .	...	x	...	x	...	...	H. p.
	Halopyrum . .	mucronatum Stapf . .	...	x	...	x	...	...	H. p.
	Cynodon . .	dactylon Pers. . .	...	x	...	x	...	...	H. p.
	Chloris . .	villosa Pers. . .	...	x	...	x	...	...	H. p.
	Eleusine . .	aegyptiaca Desf. . .	...	x	...	x	...	...	H. a.
	Enneapogon . .	brachystachyus Stapf . .	...	x	...	x	...	...	H. p.
	Æluropus . .	villosus Trin. . .	...	x	...	x	...	—	H. p.
		littoralis Parl. . .	...	x	...	x	...	...	H. p.
Gnetales	Ephedra . .	foliata Boiss. . .	...	x	...	x	...	...	F.

## 2.—General Aspects.

### (a) *Aden Peninsula.*

When J. D. Hooker visited Aden in 1847, he characterized the place as follows: "Upon the whole, it is the ugliest, blackest, most desolate, and most dislocated piece of land, of its size, that ever I set eyes on; and I have seen a good many ugly places."

The impression which the country produced upon T. von Heuglin in 1857, was not more favourable. He speaks of the "bare naked rocks which cannot find their equal in any part of the world as regards dryness, infernal heat and barrenness."<sup>2</sup>

In order to give an accurate idea of the general aspects of the flora of Aden we cannot do better than to reproduce a few extracts from Anderson and Hooker.

"The only patches of vegetation" says Anderson, "occur at the base of the gorges [narrow valleys radiating from the ridge of the Shum Shum Range], just above the sea-line; and the loose and tolerably fertile soil accumulated there consists of scoriæ mixed with sand and the detritus washed from the rocks above by the violent torrents which rush down every ravine after the rare but heavy falls of rain. Along the cliffs utter sterility reigns, except where a ledge of rock or a mass of cinder has allowed the accumulation of sufficient earth to afford sustenance to a few straggling bushes of *Capparis galeata* or *Adenium obesum*.

"*Diptyrygium glaucum*, six or seven species of *Capparidaceæ*, *Reseda amblyocarpa*, *Cassia pubescens* and *obovata*, *Acacia eburnea* and a few *Euphorbiaceæ* are the only common plants; and some of these are so plentiful, that in many places they abound to the exclusion of all other plants. The other species are either very local, or sparingly scattered over the peninsula.

"All the species are more or less peculiar in their habit, and some are so strange in their appearance as to constitute the anomalies of the natural orders to which they belong. As examples may be enumerated:—*Sphærocoma Hookeri* among *Carocyphyllaceæ*, *Adenium obesum*, with its almost globular fleshy trunk, naked branchlets bearing a tuft of leaves and an umbel of beautiful flowers, *Moringaaptera* in which the leaves are reduced to long subrigid rachis, the prickly *Jatropha spinosa*, and strongest of all, the *Aeluropus Arabicus*, a grass with short spiny leaves, so sharp, that it was with the greatest difficulty I could

<sup>1</sup> In Hooker's London Journal of Botany, VII (1848), page 307.

<sup>2</sup> Heuglin, T. von, Reise längs der Somali-Küste im Jahre 1857. In Petermann's Mittheilungen (1850), page 435.

procure specimens of it. The bright-green colour, which forms so pleasing a feature of the vegetation of the temperate and moist tropical regions of the globe, is quite unknown at Aden.”<sup>1</sup>

Hooker's observations on the flora of Aden are of particular interest. They bear testimony to his vast knowledge of systematic botany as well as to the practised eye of the expert botanist who, whilst not neglecting the details, is at once able to grasp the general and more characteristic aspects of a flora. He writes :—

“Aden is one of the most remarkable places I ever saw, and I only wonder that so little has been heard of it. It is a great, black, barren volcano, long extinct and of great age, starting abruptly from the ocean opposite the flat shore of Arabia, with which it is connected by a long, low, flat spit of sand. To the west of it is a smaller, but somewhat similar, peninsula of rugged rocks. They are like to the volcanic islands of the southern part of the Red Sea and some parts of the coast of Africa, but altogether different from the S.-W. end of Arabia. The long low beach is richly wooded with Acacias, Dates, and Mangroves, I am informed, but it is impossible to land there without being taken prisoner by the Arabs, whom we deprived of Aden. Ships do not lie off the shore, but at the N.-W. end of the peninsula, and sheltered from the N.-E. monsoon now blowing strong; and there are the coal depôts, a solitary hotel, and one or two houses of officials. The peninsula is one mass of volcanic rock, 1,700 feet high, a very ancient volcano, in short, whose crater is broken down to the eastward, where the town is placed. In this respect it resembles St. Helena, but is as sterile to look at as Ascension, or more so; for the top of Green Mountain (in Ascension) is green; while here, except in a few flat places near the coast, no green thing is to be discerned from the sea, quite three-fourths of the rock are inaccessible, the upper part consisting of a wall extraordinarily jagged and serrated, several miles long, many parts of which are no broader than a horse's back. This wall sends off spurs, so that take the peninsula where you will, you have a full front; and cut it down where you may, there is always a pointed perpendicular section. The wall forms the rim of the crater and is all but inaccessible; the slopes and land at the base are all volcanic cinders, strata of lava, dykes of basalt, and such like.

“The steepness and ruggedness of the black crags, utterly devoid of vegetation, the curious ridges of Trap, and beds of scoria, Lava, and Pumice, which extend from their bases to the sea, and the wild disconnected rocks that rise here and there from the ocean close to the shore,

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<sup>1</sup> Anderson, *Florula*, page VI—VIII.

render the scenery most striking, and in the moonlight awfully grand, most especially in twilight or sunset, when the exquisitely delicate colouring of the sky and the few scattered clouds that speckle it, contrast singularly with the wild features of the land. In the gravelly hollows a very few plants are seen, woefully wide apart, and never in sufficient quantity to give a verdant hue to even an acre of ground at this season; but I am told that grass appears in spring. The most conspicuous plant is a bushy green *Capparis* (Caper) and next a large *Reseda* (Mignonette), the commonest plant in the island: next comes a large herbaceous *Capparis* with bright golden flowers, and then rusty-looking *Acacia*-bushes, and some odd-looking Euphorbias. The shores are bold and rocky, yielding rock-oysters, but destitute of Algæ.

"On Sunday morning we started [from Steamer Point] very early for the cantonment or town, four miles off. The Governor-General, Courtenay, Captain Haines, and myself, were all the party. Our conveyance was a pretty French barouche with four horses; our road, an excellent one, wound along the beach opposite the Arab shore. At the neck of the peninsula is a steep hill leading to the "Gorge," which connects the valley of Aden with the rest of the peninsula; and here we left the carriage for Arab horses, all except the Governor, who had a Falanquin, while the carriage was dragged up after us through the fortified pass. At this place we ascended a hill to survey the fortifications, and obtain a view of the disputed points and modes of attack and defence. The scene was very grand, overlooking the flat sandy isthmus, with its Turkish and Arab forts and walls, similar to that neck connecting Gibraltar with the mainland of Spain. Below lay a village close to the neck, on a salt plain studded with houses belonging to the Hindoos employed in the fortifications, who spotted the plain with their white dresses. ... Looking north the eye detects the long sandy waste of the isthmus, with the sea on either hand, succeeded by a belt of green woods along the Arab coast; and in the distance a long yellow desert, backed by ranges of high mountains said to abound in fertile valleys blooming with the Rose of Shiraz, the Apple, Vine, and Apricot, Melon, and all the delicious flowers and fruits of Persia and Araby the blest. What a contrast to our present site! And it is from these distant hills that Aden is constantly supplied with vegetables, brought for sale by the Arabs. To the right of this position is the great black gulph in which Aden is built, a sort of valley of Acheron, unblest by water or any verdure, sprinkled with the white hovels of the natives, and, scarcely better, the long cantonments of the troops. On both sides are valleys, long steep naked gorges which run up the flanks of

the mountains, mysterious—looking rents, leading to a distant black flat, which on this side of the island extends along the base of the highest ridge. This highest ridge is, as well as the spurs it gives off, in every point of view, remarkable, being always a serrated wall or knife-edge of rock, apparently inaccessible, but covered here and there with the ruins of Turkish castles.

“At the town we went to Captain Haine’s house, where he is endeavouring to wheedle garden plants into growth, and has succeeded with some short-lived annuals, which only want a winter; but the rest of those, whose duration is longer, perish with the following dry season. The heat of this valley is always  $10^{\circ}$  above that of the ‘Point’ and the residents are all but roasted alive. At the Residency (Captain Haine’s) we were met by the Assistant Political Agent, Lieutenant Cruttenden, I. N., and the Civil Surgeon, Dr. Vaughan, successor to Dr. Malcolmson, whose absence I much regretted. In Cruttenden I recognized a contributor to the Transactions of the Royal Geological Society. He is a very agreeable and intelligent officer, and an experienced traveller in Nubia, Abyssinia, East Africa and Arabia.

“In the evening, while the Governor-General took some needful repose, I went to the top of the ridge or highest part of the island, “Shumsun,” as it is called, 1,700 feet of elevation. I had two “Soumalis” to carry my things, a large umbrella, broad white hat, with a round pillow on the crown, and a bolster round the rim outside, which keeps the sun’s rays from striking through the hat to one’s head. We scrambled up one of the gullies over stony barren hills that led to the flat. The latter is about 800 feet up, a black waste of volcanic cinders, utterly destitute of vegetation or life, and so heated that the atmosphere for some feet above it flickered like smoke. Though now mid-winter it was dreadfully hot, the soil below the surface being  $107^{\circ}$  at 2 P.M., which must be far below the summer heat. A few valleys occur here and there, and these are sprinkled with vegetation, some shrubby milky *Euphorbiaceæ* and *Asclepiadaceæ*, several gummy *Acacias*, the *Reseda*, four or five *Capparideæ*, shrubby and herbaceous, one or two wiry grasses, and a very common plant belonging probably to *Pedalineæ*. About the plains the ridge of rocks runs like a wall, some four miles long, curiously jagged at the top, which towered 1,000 feet above my head, and appeared inaccessible, except in one place, where a steep slope led to a cleft in the ridge, and up whose steep face a zigzag road was formed: to this I directed my course. At the foot of the rocks I found a few more

plants in the beds of the dry water-courses; but none were in flower. All were Arabian-looking *Antichorus*, *Tephrosia*, *Polygala*, *Amaranthaceæ*, *Acacias*, *Rutaceæ*, and *Capparidaceæ* always prevailing, with a frutescent *Lycium*. The shrubs were in woeful and dead-like plight, having very stout distorted spiny stems, short woody branches, few leaves, and no flowers. A leafless, pale, yellow-white, dichotomous *Euphorbia* was perhaps the most common.

"The road to the top of the ridge was remarkable, where perfect, but much of it is broken away; the workmanship is so good that no one suspects the Turks of having constructed it, but people assert that it was formed, as well as the crowning forts, by captive Jews, under Solyman the magnificent.

"Towards the top I met with two specimens of a plant which I recognised to be the same as a shrub shown to me by Dr. Lindley some two years ago, at the Gardens of the Horticultural Society. It has a curious stem eight or ten feet high, expanding like a trumpet at the base, a few short branches and rounded lobed leaves. I saw no young plants, nor fruit, nor flower, and could only reach a twig from the road. The Horticultural Society plants were, if I remember rightly, covered with *Dufourea flammea*, and were probably from another part of the island. At this elevation, 1,500 feet, I met with Lichens, on the rocks, crustaceous species, and on Acacia stems, *Roccella* and *Ramalina*; but no other *Cryptogamia*. The road met the ridge at a curious cut, as it were, in the wall and on reaching the latter, a general view opened out of the west side of the peninsula, the bay, and steamers at anchor off the 'Point,' where Captain Haine's house is situated.

"At the top there is a signal station, and a soldier on duty, who, besides signalizing the shipping, takes meteorological observations. This rocky crest is, of course, very barren of everything but Lichens of which there is a fair sprinkling; but I had no time to stay to collect them. My descent was less fatiguing; though the causeway is formed of such slippery stones that it tired me as much as the ascent. Exclusive of the few plants, some forty species, there is little to be gained by the hot and dusty ascent of 'Shumsun,' always excepting the remarkable views, and the curious works of the Turks."

"On the Monday morning I went out at day-break to gather what plants I could find in the cooler valleys facing the west: they were more luxuriant than on the eastern side, the soil being more gravelly; but still sterility was the order of the day. I added about twenty kinds to my former collection, but nothing remarkable on a casual inspection, or attractive at this flowerless season. Along the beach I did not procure

a single maritime plant, nor an *Alga*: a dichotomous-leaved *Poa*, and a *Cyperus*, both growing in scattered tufts, occupying all the sand whilst the rocks were invariably naked. Further back, the *Cleome* was abundant, with several smaller *Capparideæ*, the universal *Reseda*, some herbaceous and shrubby *Euphorbiaceæ* and *Leguminosæ*. A small weeping tree, ten feet high, possibly *Osyris*, was the largest plant. Several *Zygophylleæ*, *Fagoniæ*, and some *Rubiaceæ* were plentiful; a filiform *Mathiola* (?) and a suffrutescent *Campylanthus*, a pretty Acanthaceous plant, two *Labiataæ*, one *Boragineæ*, and some *Scrophularineæ* were also common.”<sup>1</sup>

The dominant species which give the vegetation of Aden its characteristic feature are *Dipterygium glaucum*, *Cleome paradoxa* *Capparis galeata*, *Reseda amblyocarpa*, *Sterculia arabica*, *Cucumis prophetarum*, *Vernonia atriplicifolia*, *Salvadora persica*, *Glossonema Boveanum*, *Boerhaavia elegans*, *B. verticillata*, *Jatropha spinosa*, and *Euphorbia Schimperii*. All of them, with the exception of two are essentially tropical and do not belong to the flora of Arabia Petraea.

Neither ferns nor mosses nor *fungi*, have been observed in the peninsula of Aden. The *algæ*, inhabiting the wells and tanks, have to our knowledge never been collected and described. A few lichens, which will be described below, are the only representatives of cryptogamic plants.

Of the 250 species occurring in the British territory, no less than 228 have been reported from the peninsula of Aden.

#### b. Little Aden.

The flora of Little Aden is, according to Defflers, on the whole the same as that of the peninsula of Aden. But, in spite of its covering a larger area, the variety of plants is smaller owing probably to the greater dryness of the place. The ravines of Jebel Ishan harbour some interesting species which seem to be confined to those localities. In one of the valleys we find *Dobera glabra* (*Salvadoraceæ*) which occurs nowhere in the neighbouring country and which must have been carried there by some chance. The following species have been noted in Little Aden which apparently do not occur in other parts of the British territory: *Atriplex farinosa*, *Littonia minor*, *Dipcadi erythraeum*, *Andropogon Iwarancusa*, *Panicum turgidum*.

<sup>1</sup> In Hocker's London Journal of Botany VII (1848) 307—314.



### 3. Adaptation.

In order to give a more complete aspect of the flora of Aden, a few notes may be added which are apt to give a better insight into the life-functions of a vegetation that has to thrive under such unfavourable conditions as are those of Aden. The account will, naturally, be fragmentary. On many interesting points of ecology no observations are available, and we do not wish to repeat in this place a number of morphological details which will be found below in the descriptive part of the book.

We need scarcely mention that the flora of Aden is of a distinctly xerophytic character and that nearly all of its members show some effect or other of adaptation to the abnormal conditions of soil and climate.

In most xerophytes we observe a deep-seated root system, which enables them to draw water from the lower moist soil. We cannot say to what extent modifications of roots have been developed in Aden. Things like these can only be observed on the spot, and it is quite useless to speculate upon the function of long and short, thick and thin, vertical and horizontal roots that you may find in a herbarium, if you are not told at the same time, where they were growing, at what depth water was to be found at a certain period of growth, whether dew might have influenced the development of roots at a certain time of the year, etc. The same holds good if we want to know some details regarding the absorption of moisture and dew by subaerial organs, whether the process consists in the condensation of moisture by secretion of hygroscopic salts or in the absorption of rain and dew by trichomes. In both cases minute hygrometric observations and careful experiments on the living plant are required.

With regard to transpiration we may safely state at the outset that such abnormal thermometric and hygrometric conditions as prevail at Aden must necessarily lead to excessive evaporation from the plants and consequently to their destruction, if there are not special protective modifications in the organs of the plant-body counteracting the adverse influences. Another factor, in addition, should not be overlooked, *viz.* insolation. The vegetation is exposed to its influence almost throughout the whole year, and the edaphic formation of Aden can only increase its intensity. Statistical accounts as to the values of insolation in Aden are entirely wanting, as far as we are able to ascertain, and much less are we allowed to expect observations regarding the degree to which the heat of the soil raises the temperature within the plant.

Amongst the many contrivances for regulating the water-supply, the most efficient protection from too great a loss of water by transpiration is obtained by the reduction of the evaporating surface. Of the numerous plants which have their leaves reduced in size, and sometimes also in number, we mention : *Farsetia longisiliqua*, *Cocculus cebatha*, *Dipterygium glaucum*, *Cleome papillosa*, *Cleome brachycarpa*, *Cl. paradoxia*, *Mærua Thomsoni*, *Cadaba glandulosa*, *Polygala erioptera*, *Polycarpæa corymbosa*, *Sphærocoma Hookeri*, *Corchorus antichorus*, *Grewia populifolia*, *Zygophyllum simplex*, *Commiphora opobalsamum*, *Moringa aptera*, *Indigofera semitrijuga*, *I. arabica*, *I. paucifolia*, *I. parvula*, *Taverniera glauca*, *Rhynchosia minima*, *Oldenlandia Schimperii*, *Heliotropium strigosum*, *Convolvulus glomeratus*, *Linaria macilenta*, *Schweinfurthia pterosperma*, *Campylanthus junceus*, *Lavandula setifera*, *Saltia papposa*, *Suaeda fruticosa*, *S. vermiculata*, *Euphorbia arabica*, *E. cuneata*, *E. systyla*, *Ephedra foliata*.

The leaves of many plants are quite normal as regards size and shape, in which case various structural modifications bring about the necessary decrease in transpiration.

A very common modification is the cutinized leaf, in which the outer wall of the epidermis is thickened and rendered impervious by the addition of cutin. The cuticle, filling sometimes half or more of the cell cavity, is usually thicker upon the upper surface of horizontal leaves; upon upright or oblique ones it is more uniformly developed. The texture of cutinized leaves is usually leathery. Practically most Aden-plants with smooth leaves of the normal form belong to this type.

Another modification, well represented in Aden, is the lanate leaf. It is distinguished by dense hairy coverings upon one or both surfaces. The hairs may be short, long, repeatedly branched or curved, and even glandular. Where there is a dense layer of hairs, the epidermis is usually not provided with a cuticle. The function of the hairs is to decrease transpiration by protecting the epidermis; the amount of light and heat is diminished and the access and movement of dry air impeded. It is evident that a few scattered hairs are of little or no value for this purpose. Examples of this type are : *Farsetia longisiliqua*, *Diplotaxis pendula*, *Polygala erioptera*, *P. Thurmanniana*, *Polycarpæa fragilis*, *Melhania Denhamii*, *Tribulus terrestris*, etc.

A third modification is the so called storage-leaf, containing water storage cells in the chlorenchyma. Their function is to increase the water supply by storing the surplus of absorbed water against a time of need. Examples : *Mærua crassifolia*, *Zygophyllum simplex*, *Portulaca quadrifida*, *Sphærocoma Hookeri*.

Reduction of surface is also brought about by the division of the leaf blade into narrow linear or thread-like segments. The decrease in exposed surface is considerable in this case.

In a great number of plants the amount of leaf surface exposed to dry air is reduced by rolling or folding of the leaf. The edges are usually rolled up with the lower side inward, owing chiefly to the greater turgidity of the upper. In many plants the leaves are permanently rolled or folded. In these cases the stomata lie in a chamber that is permanently and more or less completely closed. In consequence of this the protection against drought is very effective. Examples: *Eragrostis mucronata*, *E. cynosuroides*, *Sporobolus spicatus*, *Aeluropus villosus*, *Aristida Adscensionis*, *A. plumosa*, *A. hirtigluma*, *Polycarpæa fragilis*, *Zygophyllum simplex*.

In many species the leaves either fall off early or are reduced to functionless scales. The stems are usually thin, erect, and rod-like. A characteristic example is *Ephedra*. Virgate stems may be seen in *Maerua Thomsoni*, *Hibiscus micranthus*, *H. Welshii*, *Commiphora abyssinica*, *C. opobalsamum*.

In *Cocculus cebetha* the bigger leaves fall off very soon whilst a few of the smaller ones remain. The former are characterized not only by their greater size, but also by their anatomical structure. They are usually thinner, more pointed, and entirely devoid of hairs. The stomata are almost superficial and equally distributed over both surfaces. The remaining leaves, on the other hand, are covered with thin-walled hairs which, even when the leaf is dry, absorb water very easily.

In too bright and intense illumination the leaflets of *Cassia obovata* change their transverse position into a line more or less parallel with the direction of the rays of light. By assuming this perpendicular position the upper sides of each pair of leaflets cover each other and thus reduce the transpiring surface considerably; in this case, besides, only the margins of the leaflets are exposed to the rays of the sun.

Many Aden plants have greyish-white stems and leaves. This colour is often due to a very thin layer of wax which covers all the green parts of the plant, thus protecting the tissues against too profuse transpiration. We mention only *Capparis spinosa*, in which the chlorophyll of the leaves shines faintly through the coat of wax.

In a few plants transpiration is diminished by the deposition of a mucilaginous substance in the epidermal cells, v. g. in *Zizyphus spina Christi*, *Moringa aptera*, and *Cassia obovata*.

We must not forget to mention another characteristic feature of desert plants, the production of spines. "Though in many cases,"

writes Anderson, "the development has not attained actual spinosity, still in rigid or distorted branches and asperities of stem and leaf bears witness to the modifying influence of the climate. Of the ninety-four species [of Anderson] that constitute the flora, sixteen bear sharp thorns on some part of their structure. In some the leaves terminate in sharp, recurved hooks; in others the stipules are spinous, in a few the bracts are prickly, and in *Lycium europæum* and *Euphorbia cuneata* the short stiff branches are terminated by short thorns." Of the many species which show one or the other of these modifications we mention; *Capparis galeata*, *Egonia cretica*, *Zizyphus lotus*, *Z. spina Christi*, *Spharocoma*, *Hookeri*, *Acacia Edgeworthii*, *A. eburnea*, *A. hamulosa*, *A. spirocarpa*, *A. nubica*, *Bleharis edulis*, *Jatropha spinosa*, *Alhagi maurorum*.

"Several species yield gums or resinous matter, and their stems frequently become encrusted by these exudations, probably caused by the bark cracking from the exposure to the great heat of the sun. I have observed resinous substances accumulated in various quantities on *Balsamodendron opobalsamum*, *Acacia Edgeworthii*, *Adenium obesum*, and the shrubby *Euphorbia*. All the *Capparidaceæ*, [of Anderson] (with the exception of *Mærua Thomsoni*), *Dipterygium glaucum*, *Reseda amblyocarpa*, the *Compositæ* and a few others, are characterized by more or less pungency or aromatic odour,—qualities always possessed by plants of desert regions."<sup>1</sup>

#### 4. Flowering Season and Climate.

We give in the following diagram the relative values of temperature, rainfall, flowering and fruiting season during one year, beginning with April. Unfortunately no observations on humidity were available, though it is just humidity which plays an important part in the regulation of the processes of reproduction<sup>2</sup>).

The curve of temperature gives the average of the mean monthly temperature from April 1873 till March 1876 as observed in the Camp, whilst that of rainfall shows the average of the monthly rainfall from April 1872 till March 1876.

With regard to the flowering and fruiting season it is well to bear in mind that the data which form the basis of our curves stretch over a period of 60 years. The drawbacks of comparing values of different periods are evident.

<sup>1</sup> Anderson, l. c. p. VIII.

<sup>2</sup> For a fuller account of these relations see our paper on "Flowering Season and Climate," in Journ. Bomb. Nat. Hist. Soc., Vol. 17, p. 334-350, 697-708.

### 5. Plants and Animals.

It can scarcely be doubtful that observations on the relations between plants and animals in desert regions would reveal many points of special interest. Unfortunately, as far as we could ascertain, there exist no publications on the subject. As to Aden itself, all we are able to say comes from the pen of Major Yerbury, who was kind enough to send us a short list of larvæ and their food plants. All the other interesting problems connected with pollination and dissemination, in which the animal world plays such an important part, can in most cases only be a subject of conjecture for the present. Judging from various papers published on the zoology<sup>1</sup> of Aden it appears that most types of zoophilous plants may be represented in Aden: *Melittophila*, *Micromelittophila*, *Myiophila*, *Micromyiophila*, *Sapromyiophila*, *Cantharophila*, *Psychophila*, and *Sphingophila*.

Some Lepidopterous larvae and their food-plants.

Larva.	Food-plant.
<i>Glottula orientalis</i> .	<i>Pancratium tortuosum</i> .
<i>Caradrina exigua</i> .	<i>Zygophyllum simplex</i> .
<i>Acontia insignis</i> .	<i>Schweinfurthia pedicellata</i> .
<i>Ophiusa melicerte</i> .	<i>Euphorbia systyla</i> .
<i>Daphnis nerii</i> .	<i>Adenium arabicum</i> .
<i>Deilephila livorinca</i> .	<i>Boerhaavia elegans</i> .
<i>Cherocampa celeri</i> .	Do. do.

<sup>1</sup> For the convenience of Aden residents we mention the chief publications :—

- (a) Butler, A. G. On a collection of Lepidoptera made by Major J. W. Yerbury at or near Aden. Proc. Zool. Soc. (1884), No. 34, p. 478.
- (b) Gahan, C. J. On Coleoptera from Aden and Somaliland. Ann. & Mag. Nat. Hist. Ser. 6, vol. 18 (1896) p. 448.
- (c) Matschie, P. Über einige von Herrn O. Neumann bei Aden gesammelte und beobachtete Säugetiere. S. B. Ges. naturf. Freunde (1893), p. 24.
- (d) Monticelli, F. S. Note Chiropterologiche. Ann. Mus. Genov. (2) V, p. 517 (1887).
- (e) Verrall, G. H. Notes on some Syrphidæ collected near Aden by Col. J. W. Yerbury, in February and March, 1895. Trans. Ent. Soc. London (1895), p. 413.
- (f) Wulp, F. M. van der. Asilidæ from Aden and its Neighbourhood. Trans. Ent. Soc. London (1899), p. 81.
- (g) Yerbury, J. W. On the Birds of Aden and the Neighbourhood. With notes by R. Bowdler Sharpe. Ibis, Ser. 5, vol. 4 (1886), p. 11.
- (h) Yerbury, J. W. The Butterflies of Aden and Neighbourhood, with some notes on their habits, food plants, etc. Journ. Bombay Nat. Hist. Soc. 1892.
- (i) Yerbury, J. W. Further notes on the Birds of Aden. Ibis, ser. 7, vol. 2 (1896), p. 13.
- (k) Yerbury, J. W. and Oldfield, T. On the Mammals of Aden. Proc. Zool. Soc. London (1895), No. 35, p. 542.

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<i>Lophura nana.</i>	<i>Oldenlandia Schimperi.</i>
<i>Eremocossus proleuca.</i>	<i>Acacia sp.</i>
<i>Phthoropoca carpella.</i>	<i>Acacia Edgeworthii (pods).</i>
<i>Limnas chrysippus (all forms).</i>	<i>Calotropis procera.</i>
<i>Zesius livia.</i>	<i>Acacia Edgeworthii (pods).</i>
<i>Teracolus calais.</i>	<i>Salvadora persica.</i>
<i>Teracolus phisadia.</i>	<i>Salvadora persica.</i>
<i>Teracolus pleione.</i>	<i>Cadaba glandulosa.</i>
<i>Teracolus nalimede.</i>	<i>Cadaba glandulosa.</i>
	<i>Cadaba rotundifolia.</i>
<i>Catopsilia fiorella.</i>	<i>Cassia sp.</i>
<i>Belenois mesentina.</i>	<i>Capparis sp.</i>
<i>Synchlœ glauconome.</i>	<i>Cleome paradoxa (in Aden).</i>
	<i>Dipterygium glaucum (inland).</i>

R. Boehm has published some interesting biological notes<sup>1</sup> on some *Coleoptera* of the desert fauna and their relations to the vegetation. Several plants are mentioned which occur also at Aden, but whether the corresponding insects have ever been observed in our area, we are not able to say.

### 6. Colour of flowers.

Observations on the activity of insects in the process of pollination would probably explain the striking curve given below. It represents the relative prevalence of the various colours of flowers observed in the vegetation of Aden. For comparison's sake we shall add the curves of the Bombay Presidency and Germany.

It is a well known fact that, looked at from a distance white, yellow, and red stand out best from the green of the foliage, blue and violet only a little, brown scarcely at all. As white, yellow, and red are particularly attractive to insects, and as these colours are prevalent in Aden, we are justified in concluding that the insects play an important part in the pollination of Aden plants. To what extent the statement is correct can only be learned by observations.

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<sup>1</sup> Boehm, R. Notes biologiques sur quelques coléoptères de la faune désertique. In Bull. Soc. Entomol. d' Egypte (1908), p. 57-64.

## 7. Geographical Relations of the Flora of Aden.

With regard to the geographical distribution of the Aden plants we may distinguish six groups:

1. To the first belong the species which are endemic in Aden. Anderson considered 14 out of his 94 plants to be endemic, *viz.* :—

<i>Cleome paradoxa</i> R. Br.	<i>Acacia Edgeworthii</i> T. Anders.
<i>Cleome pruinosa</i> T. Anders.	<i>Ptychotis arabica</i> T. Anders.
<i>Mærua Thomsoni</i> T. Anders.	<i>Convolvulus sericophyllus</i> T. Anders.
<i>Sphærocoma Hookeri</i> T. Anders.	<i>Anarrhinum pedicellatum</i> T. Anders.
<i>Hibiscus Welshii</i> T. Anders.	<i>Campylanthus junceus</i> Edgew.
<i>Sterculia arabica</i> T. Anders.	<i>Lavandula setifera</i> T. Anders.
<i>Taverniera glauca</i> Edgew.	<i>Euphorbia systyla</i> Edgew.

Later botanical explorations, especially in S. Arabia, Eritrea, Somaliland, and Socotra, have shown that only 3 of the 14 are endemic in Aden, *viz.*, *Cleome pruinosa*, *Mærua Thomsoni*, and *Hibiscus Welshii*. In addition to these, the following species seem to be confined to Aden :—

<i>Polygala Thurmanniana</i> Chod.	<i>Heliotropium adenense</i> Guerke.
<i>Fagonia glabra</i> Krause	<i>Echiochilon longiflorum</i> Benth.
<i>Crotalaria Schweinfurthii</i> Defl.	<i>Albuca Yerburyi</i> Ridley.
<i>Pulicaria adenensis</i> Schweinf.	And the variety <i>Gypsophila montana</i> <i>var. diffusa</i> Balf.

There are, therefore, 10 species endemic in Aden, forming just  $\frac{1}{25}$  of the total number. It is more than probable, however, that further explorations of the neighbouring countries will reduce even this limited number of endemic plants.

2. The plants of the second group belong geographically to two narrow strips of land along the Red Sea, beginning at about 23 N. Lat., the one on the African side passing over into the coast region of Somaliland, whilst the other comprises Tehama and goes as far as the boundaries of Yemen and Hadramaut. To the same region belong all the islands of the Red Sea south of the Tropic of Cancer.

Aden has the following species in common with this area :

*Argyrolobium arabicum*, *Tephrosia pogonostigma*, *Acacia hamulosa*, *Corallocarpus erostris*, *Statice axillaris*, *Statice cylindrifolia*, *Heliotropium pterocarpum* (also in Socotra) *Linaria macilenta* (also in the Sinai Peninsula), *Anticharis arabica*, *Halopeplis perfoliata*, *Salsola Forskalii*, *Anabasis Ehrenbergii*, *Euphorbia Botta*, *Euphorbia cuneata*, *Sphærocoma Hookeri*.

A few are confined to S. Arabia and the northern coast of Somaliland: *Cleome polytricha*, *Cleome brachystyla*, *Gypsophila montana*, *Crotalaria leptocarpa* (also in Socotra), *Cassia adenensis*, *Steinheiliana radians*, *Convolvulus sericophyllus*, *Barleria Hildebrandtii*, *Salsola Botte*, *Euphorbia systyla*.

The following occur only in Yemen and Hadramaut: *Heliotropium paradoxum*, *Salvia papposa*, *Euphorbia adenensis*, *Sterculia arabica* (also in Socotra).

Several have been reported from Yemen alone: *Acacia Edgeworthii*, *Corallocarpus glomeruliflorus*, *Ptychotis arabica*, *Adenium arabicum*, *Caralluma adenensis*, *Caralluma Forskalii*, *Campylanthus junceus*, *Lavandula setifera*, *Littonia minor*.

We do not know the exact limits of *Pulicaria glutinosa*. Boissier gives South Arabia.

3. The third group shows a wider distribution. Its members belong to the N. African Steppe-province, which comprises Kordofan, Darfur, Sennaar, Etbai, Abyssinia, Yemen, Hadramaut, and the island of Socotra.

It is well to remember that Aden, geographically considered, belongs to this province.

The subjoined table shows the species with their respective limits of distribution. They are 42 in number, thus forming almost  $\frac{1}{6}$  of the total of Aden plants. Of these 26 have their eastern limit in Arabia, 1 in Persia, and 15 reach as far as India.

*Species belonging to the N. African Steppe-province.*

	Species.	Limit towards		Notes.
		West.	East.	
1	<i>Cleome papillosa</i> . . .	Kordofan .	N. W. India, Sind.	Also in Socotra.
2	<i>Cleome brachycarpa</i> . . .	" .	Punjab . .	" "
3	<i>Cleome paradoxa</i> . . .	" .	S. Arabia .	
4	<i>Cadaba rotundifolia</i> . . .	" .	" . .	" "
5	<i>Cadaba glandulosa</i> . . .	" . .	" . .	
6	<i>Cadaba longifolia</i> . . .	Sennaar . .	" . .	" "
7	<i>Reseda amblyocarpa</i> . . .	Abyssinia .	" . .	



	Species.	Limits towards		Notes.
		West.	East.	
8	Melhania Denhami . . .	Kordofan	Sind . . .	
9	Commiphora abyssinica . . .	" . . .	S. Arabia . . .	
10	Indigo fera semitrijuga . . .	Sennaar . . .	Sind . . .	Also in Usagara- Usambara.
11	Indigofera arabica . . .	White Nile	Hadramaut . . .	
12	Indigofera trigonelloides . . .	Abyssinia	Sind . . .	Also in Afghanistan.
13	Tephrosia apollinea . . .	" . . .	S. Arabia . . .	Also in Socotra.
14	Taverniera glauca . . .	" . . .	Aden . . .	
15	Taverniera Schimperii . . .	" . . .	" . . .	
16	Poinciana elata . . .	" . . .	W. India (?) . . .	
17	Acacia spirocarpa . . .	" . . .	S. Arabia . . .	
18	Acacia nubica . . .	" . . .	Aden . . .	
19	Acacia mellifera . . .	Kordofan	Yemen . . .	
20	Acacia læta . . .	Abyssinia	Aden . . .	
21	Cucumis pustulatus . . .	" . . .	Yemen . . .	
22	Trianthema crystallina . . .	Kordofan	Punjab . . .	
23	Oldenlandia Schimperii . . .	" . . .	Sind . . .	Also Sansibar, So- cotra.
24	Vernonia atriplicifolia . . .	Nile-Land	Muscat . . .	
25	Launæa lactucoides . . .	Abyssinia	S. Arabia . . .	Also in Socotra.
26	Dobera glabra . . .	Kordofan	Yemen . . .	
27	Pentatropis cynanchoides . . .	Abyssinia	India . . .	
28	Kanahia laniflora . . .	" . . .	Arabia . . .	Also in German East Africa.
29	Convolvulus glomeratus . . .	" . . .	Punjab . . .	Also in Socotra,
30	Ipomoea calycina . . .	" . . .	W. India . . .	
31	Anticharis glandulosa . . .	" . . .	Sind . . .	Also in Socotra.
32	Bouchea marrubifolia . . .	Kordofan	" . . .	
33	Bouchea pterygocarpa . . .	" . . .	Yemen . . .	
34	Orthosiphon pallidus . . .	" . . .	Behar . . .	Also in Socotra and Travancore.
35	Euphorbia arabica . . .	" . . .	Yemen . . .	Also in Angola and Natal.

	Species.	Limits towards		Notes.
		West.	East.	
26	<i>Euphorbia polycnemoides</i> . . .	Kordofan .	Yemen . .	Also in Socotra.
37	<i>Euphorbia Schimperii</i> . . .	Abyssinia .	Persia . .	" "
38	<i>Jatropha spinosa</i> . . .		S. Arabia .	
39	<i>Forskohlea viridis</i> . . .	Abyssinia .	" . .	Also in Socotra.
40	<i>Panicum leucanthum</i> . . .	" . .	Yemen . .	
41	<i>Panicum leersioides</i> . . .	" . .	Aden . .	
42	<i>Digitaria pennata</i> . . .	" . .	Gujarat . .	

4. Under the fourth group we mention those plants which Aden has in common with the ægypto-arabic desert. It is, of course, impossible to draw a sharp line between the desert and the steppe-region. The transition from one botanical area to another is never a sudden one, and the same species may be common to both regions. We might thus have included under the foregoing group some plants, which we are going to enumerate in the following list:—

*Species belonging to the Aegypto-Arabia desert.*

	Species.	Limits towards		Notes.
		West	East.	
1	<i>Parsetia longisiliqua</i> . . .	Upper Egypt .	S. Arabia .	Also in Socotra.
2	<i>Cleome droserifolia</i> . . .	Egypt . .	" . .	Also Sinai peninsula.
3	<i>Dipterygium glaucum</i> . . .	Kordofan .	N. W. India .	
4	<i>Capparis galeata</i> . . .	Egypt . .	Sind . .	Also Sinai peninsula, Socotra.
5	<i>Capparis decidua</i> . . .	Darfur . .	Deccan . .	Also in Socotra, Tuticorin.
6	<i>Ochradenus baccatus</i> . . .	Egypt . .	Sind . .	
7	<i>Polycarpaata spicea</i> . . .	Upper Egypt .	Gujarat . .	Also in Socotra.
8	<i>Fagonia parviflora</i> . . .	" " . .	Arabia . .	
9	<i>Commiphora opobalsamum</i> . .	Nubia . .	S. Arabia .	
10	<i>Moringa aptera</i> . . .	Upper Egypt .	" . .	

	Species.	Limits towards		Notes.
		West.	East.	
11	<i>Crotalaria lupinoides</i> . . .	Kordofan	Arabia . . .	
12	<i>Indigofera parvula</i> . . .	Nubia . . .	Aden . . .	Also in Abyssinia.
13	<i>Indigofera argentea</i> . . .	Kordofan	W. India . . .	Also in Socotra.
14	<i>Indigofera leptocarpa</i> . . .	Nubia . . .	S. Arabia . . .	" "
15	<i>Alhagi maurorum</i> . . .	" . . .	Aden . . .	"
16	<i>Cassia holosericea</i> . . .	" . . .	Sind . . .	Also in Socotra.
17	<i>Cucumis phrophetarum</i> . . .	Kordofan	" . . .	" "
18	<i>Limeum indicum</i> . . .	Nubia . . .	Multan . . .	
19	<i>Iphiona scabra</i> . . .	Egypt . . .	Arabia . . .	
20	<i>Dicoma Schimperii</i> . . .	Nubia . . .	Sind . . .	
21	<i>Glossonema Boveanum</i> . . .	Upper Egypt	Yemen . . .	
22	<i>Daemia cordata</i> . . .	Nubia . . .	Baluchistan . . .	Also in Syria.
23	<i>Heliotropium lignosum</i> . . .	" . . .	S. Persia . . .	
24	<i>Arnebia hispidissima</i> . . .	Egypt . . .	Upper Gange- tic Plain.	
25	<i>Echiochilon fruticosum</i> . . .	" . . .	Arabia . . .	
26	<i>Breweria latifolia</i> . . .	Nubia . . .	Punjab . . .	
27	<i>Schweinfurthia pterosperma</i> . . .	" . . .	Arabia . . .	Also in Somaliland.
28	<i>Lindenbergia sinaica</i> . . .	Egypt . . .	" . . .	Also Sinai Penin- sula and Socotra.
29	<i>Blepharis edulis</i> . . .	Kordofan	Baluchistan . . .	
30	<i>Boerhaavia elegans</i> . . .	Nubia . . .	Punjab . . .	Also in S. W. and E. Africa.
31	<i>Cometes abyssinica</i> . . .	Egypt . . .	Arabia . . .	
32	<i>Suaeda monoica</i> . . .	Libya . . .	Deccan, Ceylon	Also in Sansibar.
33	<i>Suaeda baccata</i> . . .	Egypt . . .	Arabia . . .	
34	<i>Traganum nudatum</i> . . .	Algeria . . .	S. Arabia . . .	
35	<i>Cornulaca monacantha</i> . . .	Tunis . . .	Afghanistan . . .	
36	<i>Loranthus curviflorus</i> . . .	Nubia . . .	Arabia . . .	Also in German East Africa.
37	<i>Chrozophora obliqua</i> . . .	Kordofan	Punjab . . .	Also in Socotra.
38	<i>Pancreatium tortuosum</i> . . .	Egypt . . .	Arabia . . .	
39	<i>Pancreatium maximum</i> . . .	Nubia . . .	" . . .	

	Species.	Limits towards		Notes.
		West.	East.	
40	Dipcadi erythræum . . .	Egypt . .	Sind . .	Also in Socotra. Not in Sind.
41	Hyphæne thebaica . . .	„ . .	Arabia . .	
42	Cyperus effusus . . .	Upper Egypt .	S. Arabia .	
43	Cyperus cruentus . . .	„ „ .	Baluchistan .	Also in Palestine and Socotra.
44	Panicum turgidum . . .	Egypt . .	Gujarat . .	
45	Aristida brachypoda . . .	Upper Egypt .	S. Persia .	
46	Aristida paradisea . . .	Egypt . .	S. Afghanistan	
47	Aristida hirtigluma . . .	Tunis . .	Punjab . .	
48	Desmostachya bipinnata . . .	Egypt . .	Burma . .	Also in mediterr. and Caspian region.
49	Aeluropus villosus . . .	? . .	W. India, Ceylon.	

Of the 49 species 22 have their eastern limit in Arabia, 2 are found in Persia, and 25 in India (including Baluchistan).

5. The fifth group, forming  $\frac{1}{5}$  of the total number of Aden plants, consists of 50 species which are characteristic of the N. African-Indian desert. The following list shows their distribution. It will be seen that 15 species find their eastern limit in Arabia, 2 in Persia, whilst 33 belong also to the Indian flora.

*Species belonging to the N. African-Indian Desert.*

	Species.	Limits towards		Notes.
		West.	East.	
1.	Cocculus Cebatha .	Cape Verd Islands	Punjab, Gujarat	Also in Socotra.
2.	Diploaxis pendula .	Morocco . .	S. Persia . .	Also in Spain.
3.	Maerua crassifolia .	Senegambia .	S. Arabia.	
4.	Cadaba farinosa .	Senegambia .	„	
5.	Polycarpaea fragilis .	Algeria . .	„	
6.	Potulaca quadrifida	Lower Guinea .	India.	
7.	Grewia populifolia .	Senegambia .	W. India, Ceylon	
8.	Corechorus antichorus	Cape Verd Islands	Deccan.	

*Species belonging to the N. African-Indian Desert—contd.*

	Species.	Limits towards		Notes.
		West.	East.	
9.	<i>Corchorus trilocularis</i>	Senegambia	Sind . .	Also in S. Africa.
10.	<i>Zygophyllum simplex</i>	Cape Verd Islands	Sind . .	Also in S. W. Africa, Cape.
11.	<i>Erodium malacoides</i>	Senegambia	Persian Gulf.	Also in S. Europe.
12.	<i>Zizyphus spina Christi</i>	Senegambia	S. Arabia . .	Also in Socotra.
13.	<i>Zizyphus lotus</i>	Morocco .	Arabia.	
14.	<i>Vitis quadrangularis</i>	Senegambia	Malay Archipelago.	
15.	<i>Crotalaria falcata</i>	Upper Guinea	Aden.	
16.	<i>Indigofera paucifolia</i>	Senegambia	Java . .	Also in Socotra.
17.	<i>Rhynchosia memnonia</i>	Lower Kongo	Sind.	
18.	<i>Cassia obovata</i>	Senegambia	W. India.	
19.	<i>Citrullus colocynthis</i>	Canaries .	Punjab, Ceylon.	
20.	<i>Corallocarpus velutinus.</i>	?	Sind.	
21.	<i>Trianthema pentandra</i>	?	India.	
22.	<i>Pegolettia senegalensis.</i>	Cape Verd Island	Tropical Arabia .	Not in Sind.
23.	<i>Lactuca goracensis</i>	Upper Guinea	Yemen . .	Also in Mozambique.
24.	<i>Launæa nudicaulis</i>	Canaries .	Punjab . .	Also in S. Spain.
25.	<i>Salvadora persica</i>	Senegambia	India, Ceylon.	
26.	<i>Calotropis procera</i>	Canaries .	Irawady.	
27.	<i>Heliotropium zeylanicum.</i>	Senegambia	Punjab, Deccan.	
28.	<i>Linaria sagittata</i>	Canaries .	Arabia.	
29.	<i>Anticharis linearis</i>	Senegambia	Punjab.	
30.	<i>Ruellia patula</i>	?	Deccan, Ceylon.	
31.	<i>Boerhaavia verticillata</i>	Senegambia	W. India . .	Also in the Carnatic.
32.	<i>Boerhaavia repens</i>	„	Aden . .	Also in Angola.
33.	<i>Acrua tomentosa</i>	Cape Verd Islands	India, Ceylon .	(Not in Java.)

	Species.	Limit towards		Notes.
		West.	East.	
34.	<i>Suaeda vermiculata</i> .	Canaries .	Arabia.	
35.	<i>Euphorbia granulata</i> .	„ .	Punjab.	
36.	<i>Jatropha lobata</i> .	Senegambia .	Arabia.	
37.	<i>Forskohlea tenacissima</i> .	Canaries .	W. Punjab.	
38.	<i>Commelina albescens</i> .	?	Sind.	
39.	<i>Cyperus conglomeratus</i> .	Senegambia .	W. India, Ceylon	Also in the Laccadive Islands.
40.	<i>Andropogon foveolatus</i> .	Canaries .	Deccan.	
41.	<i>Andropogon Iwarim-cusa, var.</i>	Morocco .	N. India.	
42.	<i>Tricholæna Teneriffæ</i> .	Canaries .	W. India .	Also in Sicily.
43.	<i>Aristida pumila</i> .	Morocco .	S. Arabia.	
44.	<i>Aristidaplumosa</i> .	Morocco .	W. Tibet.	
45.	<i>Aristida mutabilis</i> .	Senegal .	S. India.	
46.	<i>Sporobolus glaucifolius</i>	?	W. India.	
47.	<i>Sporobolus spicatus</i> .	?	Deccan .	Also in Socotra.
48.	<i>Sporobolus robustus</i> .	Cape Verd Islands	Aden.	
49.	<i>Chloris villosa</i> .	Canaries .	Rajputana.	
50.	<i>Aeluropus littoralis</i> .	Algeria .	Arabia .	Also in Sind.

6. Under the sixth group we unite those plants reported from Aden which show a still wider distribution than the species enumerated above.

The following plants have been observed over a great part of the Old World:—

*Abutilon fruticosum*.  
*Hibiscus micranthus*.  
*Cerchurus olitorius*.  
*Tribulus terrestris*.  
*Orygia decumbens*.  
*Mollugo Cerviana*.  
*Pluchea indica*.

*Ocimum suave*.  
*Aerva lanata*.  
*Celosia argentea*.  
*Suaeda fruticosa*.  
*Aristolochia bracteata*.  
*Phyllanthus maderaspatensis*.  
*Pennisetum cenchroides*.

*Heliotropium strigosum.*  
*Heliotropium undulatum.*  
*Eycium europæum.*  
*Cistanche lutea.*

*Setaria verticillata.*  
*Panicum antidotale.*  
*Eragrostis major.*  
*Enneapogon brachystachyus.*

Other species are known to occur in various parts of both hemispheres :—

*Polycarpaea corymbosa.*  
*Fagonia cretica.*  
*Crotalaria striata.*  
*Trianthema monogyna.*  
*Ipomoea biloba.*  
*Amarantus viridis.*  
*Amarantus polygamus.*  
*Euphorbia hypericifolia.*

*Setaria viridis.*  
*Panicum colonum.*  
*Eriochloa polystachya.*  
*Aristida adscensionis.*  
*Eragrostis ciliaris.*  
*Cynodon dactylis.*  
*Eleusine ægyptiaca.*

A few species do not belong to any of the preceding groups, most of them occurring only east of Aden. We give their respective areas :

*Cleome quinquenervia*, S. Arabia, S. Persia, Sind, Afghanistan.

*Maerua ovalifolia*: Western India.

*Argyrolobium roseum*: Persia, Baluchistan, Sind, N. W. India, up to 7,000 feet.

*Acacia eburnea*: Baluchistan, Afghanistan, India.

*Kissenia spathulata*: S. W. Africa, Yemen, Hadramaut.

*Oldenlandia stricta*: S. India, Ceylon.

*Salvadora oleoides*: Sind, Rajputana, Punjab, Gujarat.

*Heliotropium ophioglossum*: S. Arabia, Somaliland, S. Persia, Baluchistan, Sind.

*Schweinfurthia pedicellata*: Socotra, Sind.\*

*Cometes surattensis*: Muscat, S. Persia, Waziristan, Baluchistan, Sind.

*Halopyrum mucronatum*: S. Arabia, N. India.

*Ephedra foliata*: Syria, Turkestan, S. Persia, Afghanistan, W. Punjab, Sind.

## S. The Origin of the Flora of Aden.

It is evident from the above tables that the greater part of the flora of Aden is composed of species belonging to the Indo-African desert and the N. African steppe. The considerable number of species which are common to Aden and the countries bordering the Red Sea on the opposite side form a particularly striking feature. It was just this similarity of vegetation which induced some scientists to assume on old continent as the centre of origin of this flora.

That India and certain parts of Africa were united in mezozoic times into one great stretch of nearly continuous dry land is now proved by

overwhelming evidence taken from the Jurassic fossils as well as from the Cretaceous deposits. The great revolutions in physical geography, which took place towards the end of the Cretaceous and during early Tertiary times, resulted in the break-up of the old continent, and were followed by the rise of the Himalayan range.

At the same time, perhaps, or at a later period a great depression of land took place which resulted in the formation of the Red Sea and consequently in the separation of what is now called Arabia and Abyssinia. Along both shores of the Red Sea and of the Gulf of Aden there is known to be a great development of volcanic rocks. There is every probability that these, so far as they are known, belong to one series, and as some active volcanoes still exist in the sea, and cones quite unchanged in form and evidently of recent date abound in many places along the coast, it is clear that the series is still in progress of formation, and that it is, in part at least, of recent date. Although there can be little doubt of the recent date of a large portion of this series, the great amount of denudation which parts of it have undergone around Zulla and Massowa and also at Aden seem to prove that these portions of the series are of a more ancient date, but not older than the Pliocene rocks.

It is therefore impossible that the flora of Aden developed independently during a geological period of long duration. We must, on the contrary, conclude, that it is the product of species imported from the neighbouring countries. This view is strengthened by the fact that the plants endemic in Aden are very few in number.

### 9. Means of dissemination.

If the flora of Aden, as we have shown above, is the product of immigration, it is evident that the plants must be provided with special modifications facilitating migration from one place to another.

Without entering into a detailed description of those modifications we wish to show the possibility of migration of the plants of Aden under the action of the chief distributing agents, *viz.* wind, water, animals, man, and mechanical propulsion.

#### (a) *Wind.*

Practically all terrestrial plants in which modifications for increasing the surface of seed or fruit have been greatly developed belong to the group of wind-distributed species. Winged, sack-like, hairy, plumed and



some awned seeds and fruits are the various types of modification for wind-distribution.

(a) Winged. This group includes all winged, margined or flattened fruits and seeds.

(α) Flat, broad fruits : Species of *Cassia*, several *Acacias* v. *g.*

*A. hamulosa*, *mellifera*.

(β) Winged fruits or seeds : *Atriplex fariuosa*, *Dipterygium glaucum*, *Farsetia longisiliqua*, *Compylanthus junceus*.

(γ) Fruits with persistent wing-like calyx : *Heliotropium pterocarpum*, *Kissenia spathulata*. In the latter the sepals develop into long wings.

(δ) Fruits with spreading glumes: *Eragrostis ciliaris*, *Eleusine ægyptica*.

(b) Sack-like. The species belonging to this group possess various fruits all of which agree in having a sack-like envelop. If it is membranous it serves for wind-distribution : most species of *Crotalaria*, *Tephrosia pogonostigma*.

(c) Comate. Fruits and seeds with long silky hairs and bristles, often plumose, belong to this group : most species of *Aristida*, *Tricholœna*, *Andropogon Iwarancusa*, *Saltia papposa*, *Polygala Thurmanniana*, *P. erioptera*, *Heliotropium lignosum*, the seeds of the various species of *Asclepiadaceæ* *Apocynaceæ*, and *Compositæ* (pappus).

(d) Small spherical or discoid seeds which are often less than 1 mm in diameter may be carried away by the wind : species of *Cadaba* and *Cleome*, some *Indigoferas* and *Acacias*, *Diplotaxis pendula*, *Reseda amblyocarpa*, *Oldenlandia Schimperii*, *Anticharis arabica*, several *Euphorbias*.

#### (b) Water.

To this group belong all plants distributed by water, whether in the form of ocean currents, tides, streams, or surface run-off. It is evident that, with regard to Aden, the sea alone can play an active part in the immigration of species from neighbouring countries.

The plants of this group possess various fruits, but all have an envelop impervious to sea-water and containing large or smaller air-cavities. Species of *Suaeda*, *Halopeplis perfoliata*, *Traganum nudatum*, *Thespesia populnea*.

(c) *Animals.*

Animals help in the distribution of species in consequence of attachment, carriage, or use as food. Distribution by animals often plays a striking part on account of the great distance to which the seeds may be carried. Various types of fruits facilitate this kind of distribution.

(a) *Fleshy fruits* : They are scattered in consequence of being swallowed, especially by birds. The seeds retain their power of germination only in those cases in which they are protected by a stony or otherwise tough envelope which enables them to resist digestion. To this group belong the following Aden plants : The species of *Capparis* and *Maerua*, *Lycium*, *Capsicum*, *Cucurbitaceæ*, *Zizyphus lotus*, *Z. spina Christi*, *Grewia populifolia*, *Commiphora*.

(b) *Spiny and hooked fruits*. All agree in the possession of spines, hooks or barbs, which serve for attachment. These modifications vary a good deal as regards number, size, and position.

We mention the following species as belonging to this class : *Andropogon foveolatus*, *A. Iwaraneusa*, *Eragrostis ciliaris*, *Chloris villosa*, *Aristida Ailscepcionis*, *Aristida pumila*, *Pennisetum cenchroides*, *Vernonia atriplicifolia*, *Dicoma Schimperii*, *Forskohlea viridis*, *F. tenacissima*. In the latter not only fruits but entire branches stick to any object that comes into contact with this plant. Besides *Cometes abyssinica*, *C. surrattensis*, *Sphærocoma Hookeri*, *Taverniera glauca*, *Kissenia spathulata*, *Crotalaria leptocarpa*, *C. lupinoides*.

(c) *Viscid fruits* which are more or less covered with a sticky substance : Species of *Boerhaavia*.

(d) *Man.*

Distribution by man acts through great distances and over immense areas as well as near at hand. It may be intentional, as is the case of cultivated plants, or unintentional as in many foreign weeds. A short glance at the following list of imports from different countries is apt to give an idea of the infinite possibilities of fruits and seeds being carried to Aden. If we think of the various kinds of conveyances by which the articles are brought to the coast and to the centres of commerce, of the great variety of packing materials and of the customs of men and women employed in the transport, we shall not find it difficult to understand the presence of a great number of species in the peninsula of

Aden, which otherwise would puzzle the botanist who tries to explain their origin.

Imports from the East coast of Africa : Animals, coke, coffee, dyeing materials, feathers, gums, humps, ivory, mats, provisions, seeds, shells, wood.

From Zanzibar : Fruits, grain, gums, oil, spices, wood.

From Egypt : Fruits, liquor, paper, tobacco.

From the Red Sea and Arabian Gulf : Building materials, coke, coffee, cotton, cotton piece goods, drugs, dyeing materials, feathers, fruits, grain, gums, hides, ivory, jewellery and precious stones, jute manufactures, mats, provisions, tobacco, firewood.

From the Persian Gulf and Muscat : Cotton, cotton piece goods, drugs, fruits, vegetables, grain, seeds, woollen goods.

From Cutch : Cotton piece goods, grains, tobacco.

From Bombay : Apparel, building materials, cabinet and furniture, carriages, chemicals, clocks, cordage, cotton, earthenware, glass, etc.

From Malabar : Cordage, drugs, oils, spices, wood.<sup>1</sup>

This extensive traffic is not a creation of the last century. Roughly speaking Aden has been known as a commercial centre for 2,000 years, and records exist which show that at an early date the merchants of Aden have been sending their boats to the far distant coasts of more eastern countries.

To Edrisi<sup>2</sup> (born in 1099 A. D.) we owe much valuable information on the geography of Arabia. There is, perhaps, no other traveller who can rival with him as to the variety and completeness of geographical details regarding that part of Western Asia. In the harbour of Aden he saw boats that came from Sind, from India, and from China. The latter brought, amongst other articles, the following vegetable products : aloe wood, pepper (fragrant and non-fragrant), coconuts, cardamoms, cinnamon, galanga (a fragrant herb), macis (?) myrobolans, ebony, camphor, nutmegs, cloves, rattans and other canes, and the greatest part of bitter aloe which is destined for commerce.<sup>3</sup>

Marco Polo (born in 1254 A. D.) describes the commercial route between Aden and Alexandria :

“ *En cest Aden est le port là où il vient moult de nefes d’Inde, a toute leur marchandise. Et de cest port la portent, li marchant, bien sept journées, atout petites nefes. Et, an chief de ces sept journées,*

<sup>1</sup> Hunter, l. c. p. 96, 97.

<sup>2</sup> Hartmann, J. M. *Edrisii Africa*, Göttingen, 1796; Ed. 2, §. 7, p. LXVI—LXVIII.

<sup>3</sup> *Géographie d’Edrisi traduite de l’Arabe en Français d’après deux Mscr. de la Biblioth. du Roi, accompagnée de notes par A. Jaubert, Paris, 1836, Volume I, page 51—52.*

descendent la marchandise et la chargent sus chameus et vont par terre bien 30 journées. Et puis treuvent le flun d' Alixandre ; si que par ce flun vont en Alixandre. Si que par cette voie 'd'Aden out, les Sarazins d'Alixandre, toute l'espicerie et le poivre que il ont. Car par autre voie si bonne, ne si cointe (agréable) ne la pevent il avoir en Alixandre."<sup>1</sup>

Considering these extensive relations with various countries over a long period, it is surprising that the number of geographically anomalous species in the flora of Aden is not greater.

#### (e) *Mechanical Propulsion.*

This agent of dissemination operates through insignificant distances, but is, nevertheless important owing to its cumulative action from year to year. All plants belonging to this group are provided with modifications, by which a tension in the fruit is established. At maturity this tension suddenly overcomes the resistance of the fruit and the enclosed seeds are thrown to some distance from the parent plant.

Very few plants of the flora of Aden are possessed of such contrivances :—

*Fagonia*, *Zygophyllum simplex*, *Boerhaavia*, *Euphorbia*, nearly all the species of *Indigofera* and several of *Tephrosia*.<sup>2</sup>

### 10. Gardening and Cultivation.

"So early as 1840 the attention of Government was directed to the necessity of devising some means of providing the garrison, if not the civil population, with vegetables, not only for their comfort but as a prevention against scurvy. Up to that time vegetables had been purchased from the interior and from the neighbouring parts of Mokha, Makalla and Shehr, with but moderate success. In 1841 Government sanctioned a small plot being cultivated as an experiment for six months, and in 1842 the 100 square feet which had been prepared and sown in one of the northern valleys produced nearly 2,000 lbs. of vegetables during three months when the supplies from the interior were entirely cut off.

"In 1846 two native gardeners were employed, but they could not be induced to remain in Aden. The success hitherto obtained induced Government in 1847 to direct that this garden should be kept up and extended, and a small amount towards its support was sanctioned. Celery [*Apium graveolens*, Linn.], lettuce [*Lactuca sativa*], and nohl-kohl were

<sup>1</sup> Le livre de Marco Polo par M. G. Pauthier, Paris, 1865, page 703—704.

Cf. etiam : Marino Sanudo. Gesta Dei per Francos. De Bongars, Volume II, page 22.

<sup>2</sup> For further details on dissemination and illustrations we refer to Krause, l. c. p. 60—72.

raised, earth was brought from Lahej, still only sufficient vegetables were grown to supply the hospital. However, during this year, a large number of camel-loads of vegetables arrived from the interior, consisting of pumpkins [species of *Cucurbita*], radishes [*Raphanus sativus*, Linn.], onions [*Allium cepa*, Linn.], together with melons [species of *Cucumis* and *Citrullus*], limes [varieties of *Citrus medica*, Linn.], bhendis, brinjals [*Solanum Melongena*, Linn.], and three or four kinds of bajis.

"In 1854 Sir James Outram suggested the establishment of a garden at the Hiswah, which is a piece of ground on the northern shore of the harbour, about four miles long by two broad, watered by the torrents [called Wadi al Kabir] that occasionally descend from the neighbouring hills and here discharge themselves into the sea. Government sanctioned the employment of two gardeners, a supply of seeds was sent, and an additional sum of Rs. 60 per annum was allowed for contingencies. This garden preserved a desultory existence for a few years. In 1857 gardeners were despatched to the Lahej district to instruct the people in the growth of English vegetables, seeds were sent to the Sultan, and a camel load arrived in Aden every two or three days. During 1861 and 1862 sweet potatoes [*Ipomoea batatas*, Lamk.], onions, pumpkins, bhendis, brinjals, toorai, and radishes were obtained from Makalla and the Lahej district. Upwards of 20,000 lbs. of vegetables were at that time brought into Aden annually; potatoes and onions were imported from Bombay, and it was proposed, but subsequently negatived, to revive the Hiswah scheme.

"In 1863 Colonel Merewether applied himself to the resuscitation of the garden at the Hiswah, and it was worked at a loss, 6,200 lbs. of vegetables only being produced in a year. In 1865 a Persian wheel was erected, as also a fort for the protection of the garden, and 14,095 lbs. of vegetables were raised.

"In 1866 a piece of ground about three acres in extent, near Al-Hautah, was obtained from the Sultan of Lahej, which was placed under cultivation, and the Lahej gardens together produced 37,182 lbs. of vegetables, which were supplied to the garrison." <sup>1</sup>

After 1866 the garden at Hiswah was abandoned by Government. But it appears that during the sixties and seventies the Aden Political Authorities still used to keep up a garden at this place. The garden was looked after by a Chinese convict (?), and many trees and vegetables were grown there. In 1883 the garden had, however, relapsed into desert and the well had been destroyed, so that nothing

<sup>1</sup> Hunter F. M. I. c. p. 67-68.

remained of it except the grove of date palms and a few doum palms. After heavy rain attempts are made to grow Indian corn and jowari in the neighbourhood of habitations with more or less success.<sup>1</sup>

When Brandis visited Aden in 1855, the then Assistant Political Agent Lieutenant Playfair seems to have shown keen interest in the vegetation of the station. He cultivated with great care a number of the more interesting Aden plants in the little garden surrounding his bungalow.<sup>2</sup>

An attempt was made in 1875 to naturalise the *Casuarina lateriflora*, 1,000 plants of which were sent from Réunion by Mr. Perry, His Britannic Majesty's Consul there. The experiment, however, proved unsuccessful, and General Schneider reported that it was doubtful whether abundant vegetation would prove an altogether unmixed benefit, as it might render the climate more moist.<sup>3</sup>

The only thing at all answering at present to a garden in Aden Proper (*i. e.*, the peninsula) is at the tanks. A number of foreign trees and shrubs have been planted in that place, and gardens led out, making the only evergreen spot in the Settlement. Amongst them the more conspicuous are, *e.g.*, *Thespesia populnea*, *Parkinsonia aculeata*, etc., (see below) and also some of the indigenous plants: *Adenium obesum*, *Capparis galeata*, *Poinciana elata*, some species of *Acacia*, etc.

At the houses of the Agents of the P. & O. and Messageries Maritimes, too, some plants have been collected, watered and looked after, as had also been done at the house of the 1st Assistant Resident and some others. But in all these places the space covered is not more than a few square yards.<sup>4</sup>

It would be interesting to find out what has become of the gardens mentioned by Captain Haines in a letter to Sir Charles Malcolm, dated Aden, 2nd June 1843: "You will be pleased to hear," he wrote, "that Aden continues to increase and that supplies of all kinds are plentiful, indeed everything can be obtained. The population is now about 22,000, instead of 600, as in former times. It is a busy, lively place. We have had as many as four steamers a month, and trees and gardens are springing up on all sides. The Parsis are certainly in advance of the Government gardeners."<sup>5</sup>

<sup>1</sup> Yerbury, in epist.

<sup>2</sup> Petermann's Mitteilungen (1857), p. 480.

<sup>3</sup> Hunter, l. c. p. 7.

<sup>4</sup> Yerbury, in epist.

<sup>5</sup> In Journ. Roy. Geogr. Soc. vol. 13 (1843), p. 196.

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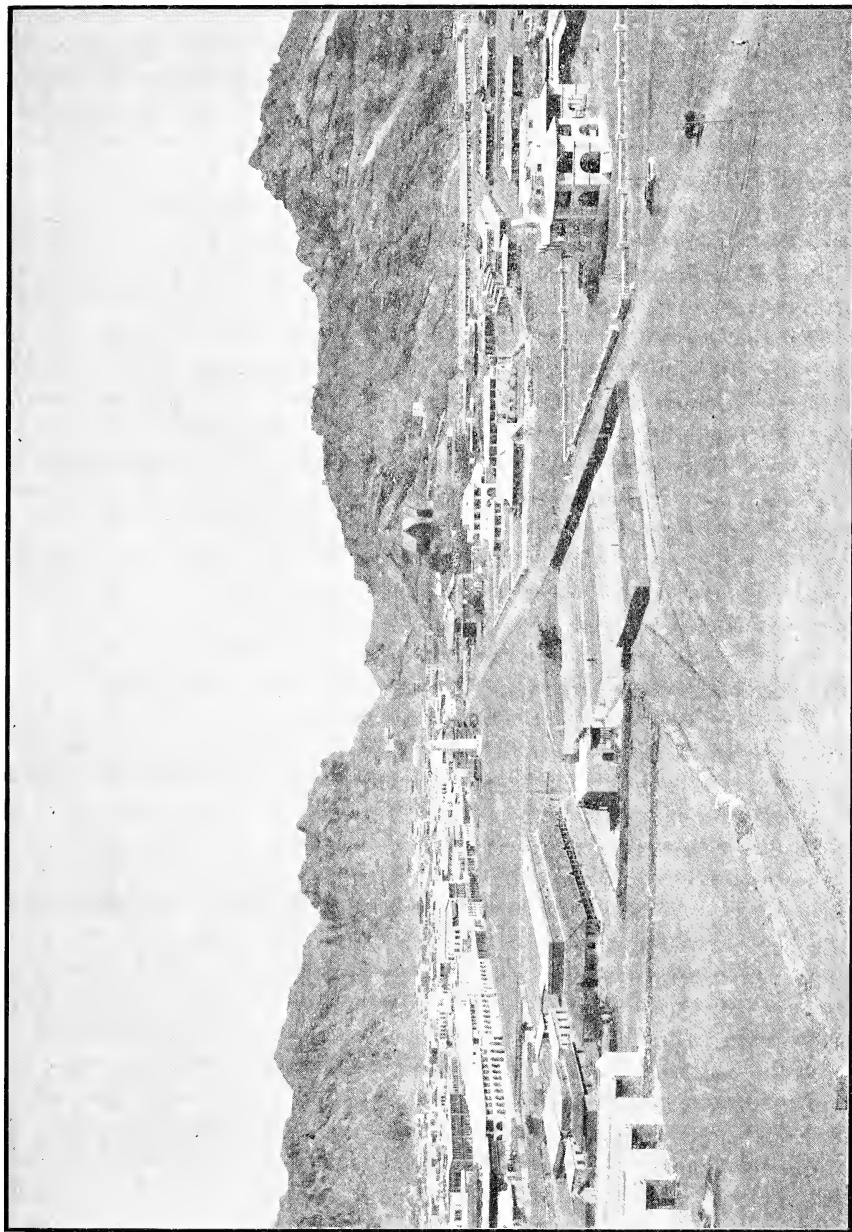
Many of the native shop-keepers have built houses at the village of Shaikh Othman, and most of those houses are surrounded by a compound. Many different crops are cultivated in these compounds, the most general being lucerne, Indian corn and jowari. In almost every compound, too, are some trees, generally date and doum palms, with perhaps local babuls and Gold Mohurs and, in addition a few foreign trees such as *Thespesia populnea*, *Parkinsonia aculeata*, *Azadirachta indica*, *Lawsonia inermis*, etc. The most interesting cultivated ground in the village is the so called 'Forest' where most of the plants are indigenous species growing under more or less natural conditions. <sup>1</sup>

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<sup>1</sup> Yerbury, in epist.

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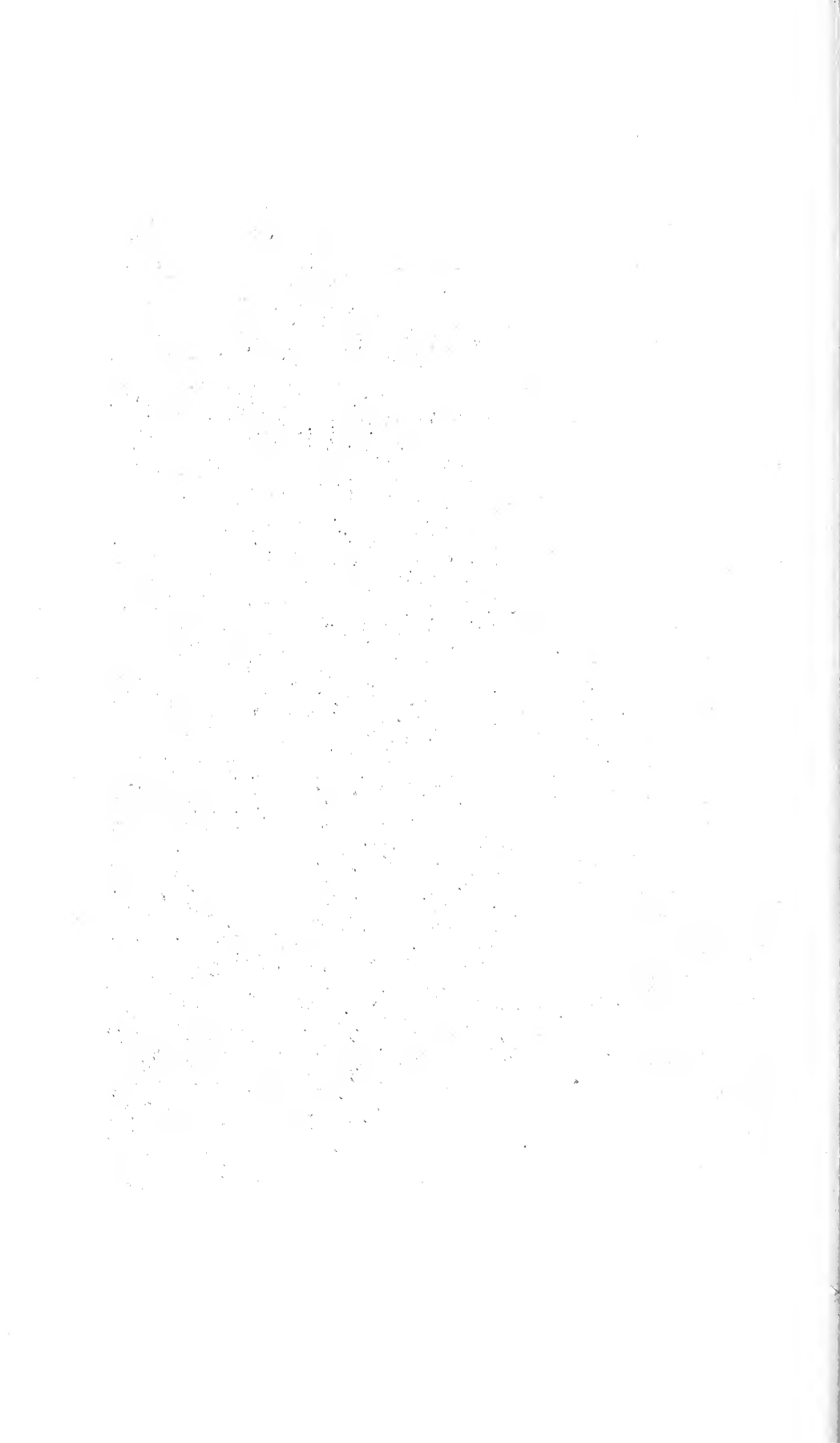


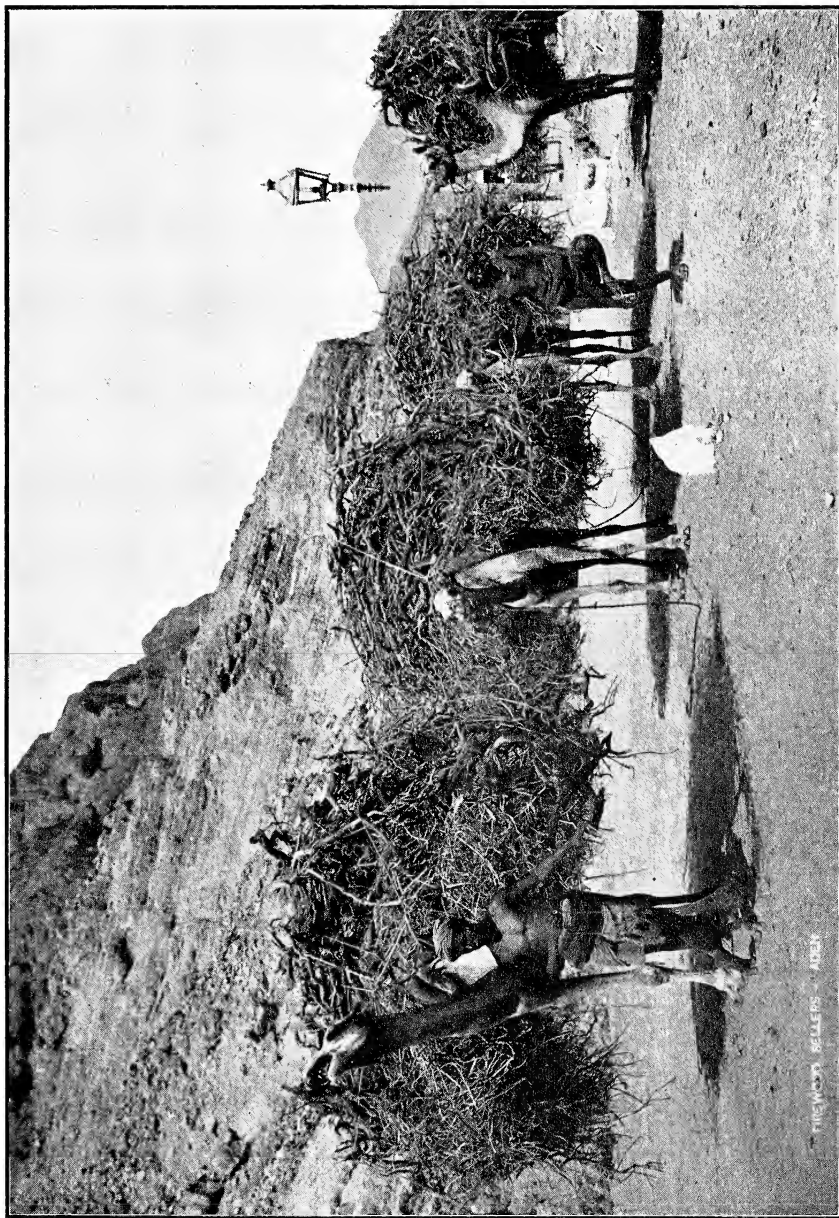


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VIEW OF ADEN FROM THE HARBOUR.



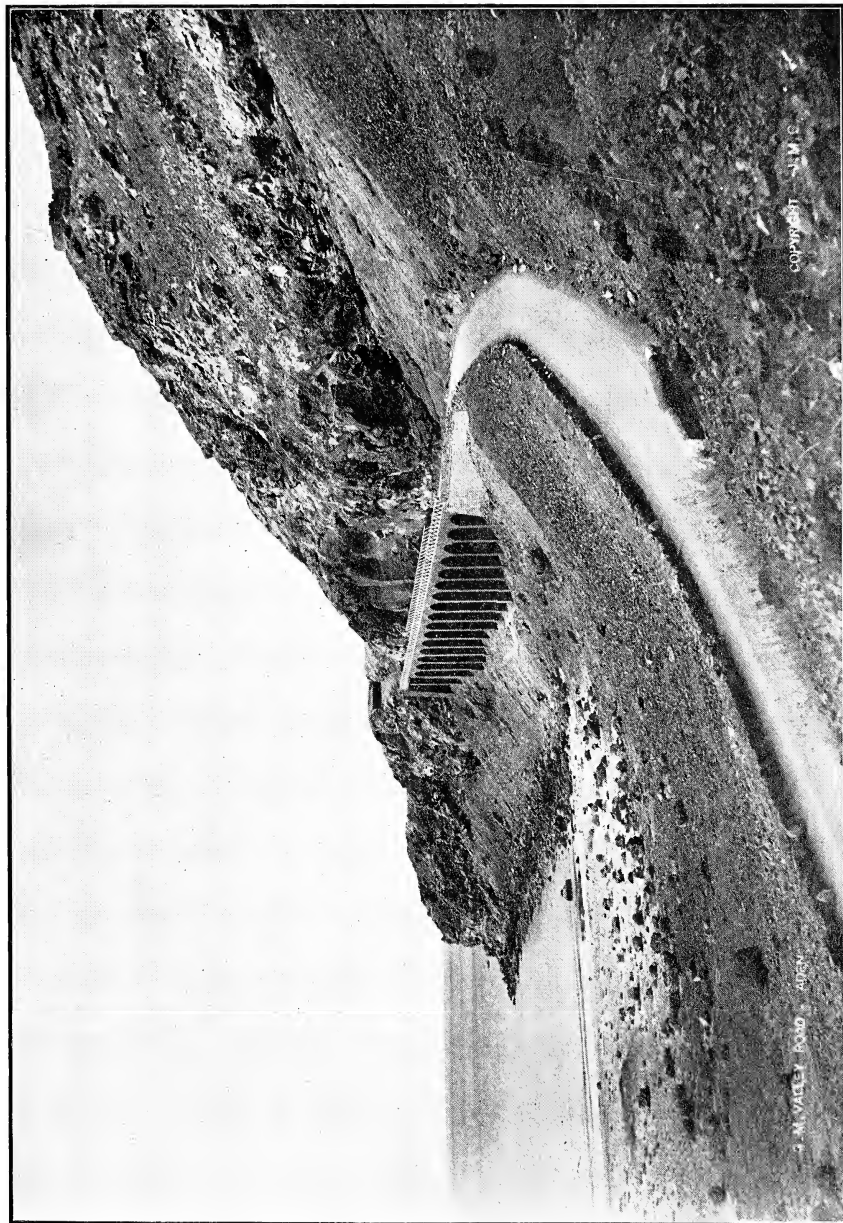


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FIREWOOD SELLERS, ADEN.





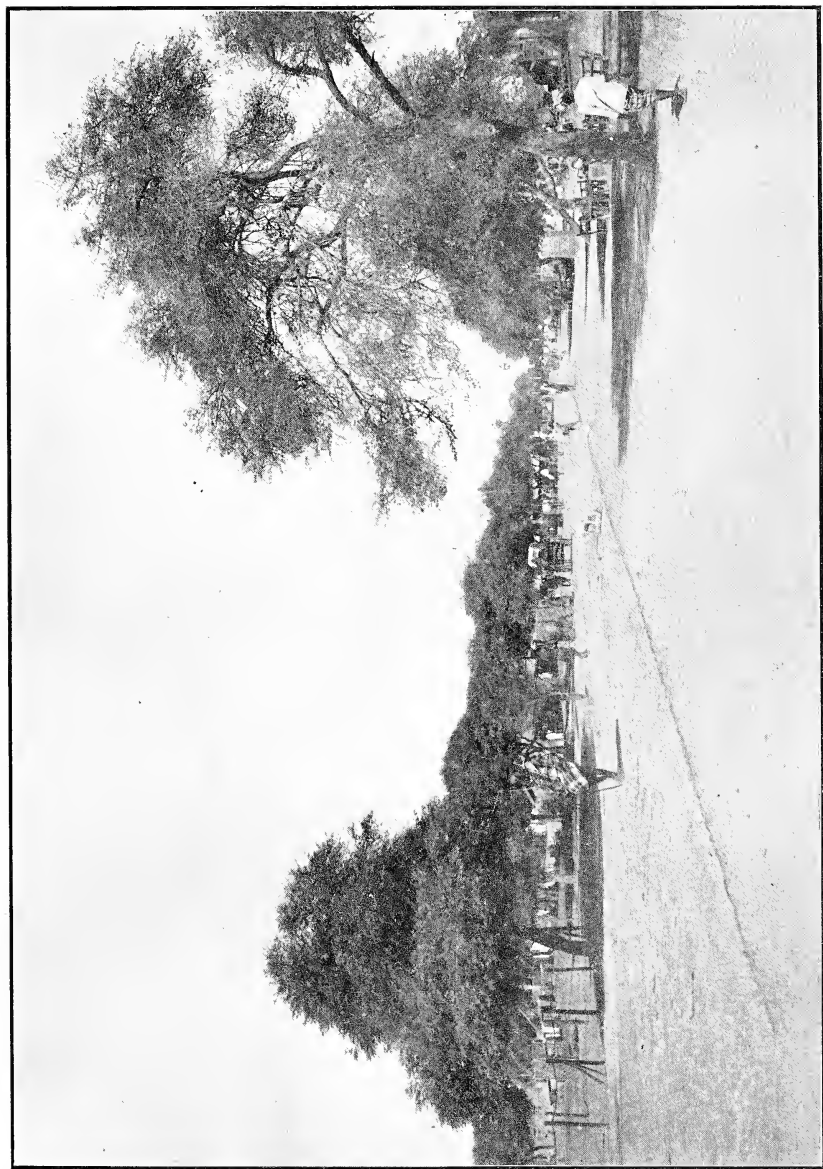
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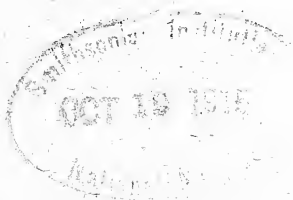
## FLORA OF ADEN

BY

ETHELBERT BLATTER, S.J., F.L.S.,

*Professor of Botany at St. Xavier's College, Bombay.*

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| <p>Thacker, Spink &amp; Co., Calcutta and Simla.</p> <p>Newman &amp; Co., Calcutta.</p> <p>R. Cambray &amp; Co., Calcutta.</p> <p>S. K. Lahiri &amp; Co., Calcutta.</p> <p>B. Banerjee &amp; Co., Calcutta.</p> <p>Rai M. C. Sircar Bahadur &amp; Sons, 75-1-1, Harrison Road, Calcutta.</p> <p>The Calcutta School Book and Useful Literature Society, 309, Bow Bazar Street, Calcutta, and 226, Nawabpur, Dacca.</p> <p>Butterworth &amp; Co. (India), Ltd., Calcutta.</p> <p>The Weldon Library, 18-5, Chowringhee Road, Calcutta.</p> <p>V. Kalyanarama Iyer &amp; Co., Madras.</p> <p>G. A. Natesan &amp; Co., Madras.</p> <p>Higginbotham &amp; Co., Madras.</p> <p>S. Murthy &amp; Co., Madras.</p> <p>Thompson &amp; Co., Madras.</p> <p>Temple &amp; Co., Madras.</p> | <p>Combridge &amp; Co., Madras.</p> <p>P. R. Rama Iyer &amp; Co., Madras.</p> <p>Thacker &amp; Co., Ltd., Bombay.</p> <p>A. J. Combridge &amp; Co., Bombay.</p> <p>D. B. Taraporevala, Sons &amp; Co., Bombay.</p> <p>Gopal Narayan &amp; Co., Bombay.</p> <p>Radhabai Atmaram Sagoon, Bombay.</p> <p>Sundar Pandurang, Bombay.</p> <p>Ram Chandra Govind &amp; Son, Kalbadevi, Bombay.</p> <p>N. B. Mathur, Superintendent, Nazir Kanun Hind Press, Allahabad.</p> <p>A. Chand &amp; Co., Lahore.</p> <p>Rai Sahib M. Gulab Singh and Sons, Mufid-i-Am Press, Lahore, and Calcutta.</p> <p>Superintendent, American Baptist Mission Press, Rangoon.</p> <p>Babu S. C. Talukdar, Proprietor, Students &amp; Co., Cooch Behar.</p> <p>A. M. and J. Ferguson Colombo, Ceylon.</p> |
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Many of the native shopkeepers have built houses at the village of Shaikh Othman, and most of those houses are surrounded by a compound. Many different crops are cultivated in these compounds, the most general being lucerne, Indian corn and jowari. In almost every compound, too, are some trees, generally date and doum palms, with perhaps local babuls and Gold Mohurs and, in addition, a few foreign trees, such as *Thespesia populnea*, *Parkinsonia aculeata*, *Azadirachta indica*, *Lawsonia inermis*, etc. The most interesting cultivated ground in the village is the so-called "Forest," where most of the plants are indigenous species growing under more or less natural conditions.<sup>1</sup>

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<sup>1</sup>Yerbury, in epist.



## IV.—SYSTEMATIC PART.

### I.—SYNOPSIS OF NATURAL ORDERS.\*

#### *First Class—Angiosperms.*

Flowers bisexual or unisexual, as a rule with a perianth, consisting of one or several whorls of leaves, free or connate (calyx and corolla). Ovules enclosed in an ovary, fertilized by the pollen-tube growing towards them through the stigma and style. Seeds enclosed in the fruit, embryo straight or curved, with or without endosperm.

#### *First Sub-class—Dicotyledons.*

Embryo with two cotyledons which, when the seed germinates, are as a rule raised above ground. Foliage leaves mostly with reticulate venation. Vascular bundles arranged in a circle in the stele; increase in thickness usually by means of a cambium layer.

#### I.—POLYPETALÆ.

Flowers as a rule with calyx and corolla; petals free.

#### *A.—Thalamifloræ.*

Calyx, corolla, and stamens usually free and arising directly from the thalamus, or from the outside of a hypogynous disk.

I. *Menispermaceæ*.—Scandent. Leaves alternate, simple; stipules 0. Flowers small, unisexual, trimerous. Stamens opposite to petals, 6. Carpels 3, free. Embryo curved.

II. *Cruciferaæ*.—Leaves alternate, simple; stipules 0. Flowers bisexual. Corolla tetramerous. Stamens tetradynamous. Fruit a siliqua.

III. *Capparidaceæ*.—Leaves usually alternate; stipules often present and spinescent. Flowers bisexual, often irregular. As a rule sepals 4, petals 4. Stamens generally numerous, sometimes 6, but never tetradynamous; filaments filiform. Carpels connate into a 1-celled ovary with 2-4 parietal placentas, often on an elongated gynophore. Embryo curved; endosperm 0 or scanty.

IV. *Resedaceæ*.—Leaves alternate; stipules minute or 0. Flowers in spikes or racemes, bisexual or unisexual; calyx 4-7-lobed. Stamens

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\* The distinguishing characters of the orders are selected mostly with special reference to the plants described below.

numerous, on a hypogynous disk. Carpels connate into a 1-celled ovary, with 2-6 parietal placentas. Seeds numerous, reniform; endosperm 0.

V. *Polygalaceæ*.—Leaves alternate, simple, entire; stipules 0. Flowers bisexual, irregular; sepals 5; petals 3. Stamens 8; filaments united into a cleft sheath; anthers opening by pores.

VI. *Caryophyllaceæ*.—Leaves opposite, entire; stipules 0 or membranous. Petals, sepals, and stamens 5; stamens in 2 whorls. Ovary 2-, 3-, or 5-merous, unilocular. Fruit usually a capsule.

VII. *Portulacaceæ*.—Fleshy herbs. Flowers surrounded by silvery hairs and an involucre. Sepals 2; petals 4. Stamens 8. Style 4-fid. Fruit a capsule.

VIII. *Malvaceæ*.—Leaves alternate, stipulate, usually palminerved. Flowers bisexual, regular, with or without involucre bracts. Sepals 5, valvate, more or less connate. Petals 5, base adnate to staminal column, contorted in bud. Stamens numerous; filaments variously connate; anthers 1-celled.

IX. *Sterculiaceæ*.—Leaves alternate, mostly stipulate. Sepals 5, valvate, more or less connate. Petals 5 or none. Stamens monadelphous. Fruit a dehiscent capsule or several distinct carpels.

X. *Tiliaceæ*.—Leaves alternate, simple; stipules deciduous. Flowers regular, bisexual. Sepals 5, valvate in bud. Stamens numerous; anthers 2-celled. Ovary 2-10-celled.

#### B.—*Discifloræ*.

Thalamus expanded within the calyx into a disk, free or adnate to calyx or to ovary. Stamens arising from the disk. Ovary usually superior, and placentation axile.

XI. *Zygophyllaceæ*.—Leaves opposite, 1-3-foliate or pinnate; stipules in pairs. Flowers bisexual; sepals and petals 5 or 4; disk annular, fleshy. Stamens not more than 10. Fruit 5-angled, of 5-12 winged or spinous or tuberculate indehiscent cocci.

XII. *Geraniaceæ*.—(Erodium) Leaves simple; stipules large. Sepals 5, imbricate. Petals 5, imbricate, with alternating glands. Stamens 5, alternating with 5 staminodes. Carpels stipitate, trigonous.

XIII. *Meliaceæ*.—Leaves alternate, pinnate; no stipules. Flowers regular, in cymose panicles. Calyx small, 5-6-cleft. Petals 5-6. Stamens twice the number of petals; filaments united into a tube. Disk between stamens and ovary.

XIV. *Burseraceæ*.—Resinous. Leaves alternate, imparipinnate, sometimes 1-foliate. Flowers small, regular. Calyx 3-5-lobed. Petals 3-5.

Stamens as many as petals or twice as many, inserted on the disk or outside at its base. Ovary 2-5-celled ; ovules 2 in each cell.

XV. *Rhamnaceæ*.—Branchlets or stipules often spinescent. Leaves simple, alternate. Flowers small, regular. Calyx 5-cleft, valvate in bud. Disk lining the calyx-tube. Ovary immersed in disk. Drupe fleshy.

XVI. *Vitaceæ*.—Climbing. Leaves alternate ; stipules small. Flowers in cymes, regular. Calyx small, truncate. Petals 4, valvate in bud. Stamens opposite to petals, inserted below the margin of the disk. Fruit a berry.

XVII. *Moringaceæ*.—Leaves deciduous, alternate, bi- or tri-pinnate ; pinnae and leaflets opposite, glands at base of petioles and pinnae. Flowers large, bisexual, pentamerous. Petals unequal. Fertile stamens 5, opposite to petals, alternating with sterile stamens. Fruit a long 1-celled 3-valved capsule.

#### C.—*Calycifloræ*.

Calyx usually gamosepalous, often adnate to ovary. Petals distinct, arising from the calyx or from a perigynous disk. Stamens perigynous or epigynous. Ovary usually inferior or included within the calyx-tube.

XVIII. *Leguminosæ*.—Leaves stipulate, as a rule alternate and compound. Flowers bisexual, in the majority of cases zygomorphic. Petals 5. Stamens 10 or  $\infty$  Carpel 1, free. Ovules usually numerous, attached to the inner suture. Fruit a 1-celled pod.

XIX. *Combretaceæ*.—Leaves simple, entire ; stipules 0. Flowers bisexual, regular. Calyx-tube adnate to ovary and produced beyond it, segments 5, valvate. Petals 0. Stamens 10, perigynous. Fruit angled or winged.

XX. *Loasaceæ* (Kissenia).—Leaves alternate. Stipules 0. Flowers in leafy cymes, bisexual. Flower-tube adnate to ovary, 10-ribbed, limb 5-lobed. Petals 10, perigynous, deciduous. Stamens indefinite, arranged in 5 bundles. Ovary inferior, 3-celled. Fruit bristly, 10-ribbed.

XXI. *Lythraceæ* (Lawsonia).—Leaves opposite, entire. Flowers in panicled cymes. Calyx cup-shaped, persistent, 4-lobed. Petals 4, inserted at the base of the calyx-tube, imbricate and crumpled in bud. Stamens 8, inserted in pairs on the calyx-tube. Ovary superior.

XXII. *Cucurbitaceæ*.—Mostly climbers with tendrils. Leaves scattered. Flowers diclinous or polygamous. Petals 5, often gamopetalous. Stamens 5, epipetalous ; anthers usually long and sinuous. Ovary inferior, unilocular, becoming spuriously multilocular. Fruit baccate, a pepo or succulent berry.

XXIII. *Ficoideæ* (Aizoaceæ).—Leaves opposite, alternate or pseudo-verticillate, simple. Stipules 0 or scarious. Flowers usually cymose or

sometimes solitary. Petals usually wanting or small. Stamens definite or indefinite, perigynous or hypogynous. Disk 0 or annulate. Ovary usually free, 2-5-celled. Fruit usually capsular.

XXIV. *Umbelliferae* (Ptychotis).—Leaves alternate, compound. Umbels axillary. Calyx-tube adnate to ovary. Petals 5, minute, distinct, epigynous. Stamens 5, epigynous. Fruit 2-celled, separating into 2 indehiscent 5-costate mericarps.

## II.—GAMOPETALÆ.

Flowers usually bisexual, as a rule with both calyx and corolla. Corolla gamopetalous.

### *Series 1.—Epigynæ.*

XXV. *Rubiaceæ*.—Leaves opposite; stipules adnate to the petiole. Flowers bisexual, regular. Calyx-tube adnate to ovary. Corolla inserted round the epigynous disk. Stamens inserted on the corolla-tube, alternating with its lobes.

XXVI. *Compositæ*.—Leaves as a rule alternate; stipules 0. Inflorescence a dense head of many small flowers, sessile on a broad receptacle and enclosed in an involucre of whorled or imbricate bracts. Calyx usually a pappus of hairs on the top of the ovary. Stamens on the corolla-tube; anthers usually connate, connective produced upwards.

### *Series 2.—Hypogynæ.*

XXVII. *Plumbaginaceæ*.—Leaves alternate, entire. Flowers regular, bisexual, pentamerous sheathed by bracts. Calyx 5-ribbed. Ovary 1-celled; ovule 1.

XXVIII. *Salvadoraceæ*.—Glabrous shrubs or trees. Leaves opposite, entire. Stipules minute. Flowers small, tetramerous. Corolla membranous. Ovary free.

XXIX. *Apocynaceæ* (Adenium).—Stem globose. Leaves entire, crowded at the end of the branches. Flowers regular, bisexual, pentamerous. Stamens 5, inserted in the corolla-tube. Carpels 2, distinct. Seeds comose; albumen scanty.

XXX. *Asclepiadaceæ*.—Leaves entire, as a rule opposite. Stipules 0. Flowers regular, bisexual, pentamerous. Calyx inferior, sepals imbricate in bud. Stamens 5, inserted on the base of the corolla; anthers cohering or connate, enclosing the stigma, pollen-grains as a rule united into waxy masses. Corona corolline or staminal. Carpels 2, distinct. Seeds usually winged and surmounted by a dense brush of hairs. Embryo large, in copious endosperm.

XXXI. *Boraginaceæ*.—Leaves as a rule alternate and simple. Stipules 0. Flowers bisexual, as a rule regular and pentamerous, in unilateral spikes or racemes. Calyx free, persistent, lobes valvate in bud. Ovary 2-celled, each cell with 2 ovules, or 4-celled and each cell with 1 ovule. Fruit consisting of 4 nutlets.

XXXII. *Convolvulaceæ*.—Leaves alternate. Stipules 0. Flowers large, bisexual, regular, pentamerous, sepals distinct, persistent. Fruit a berry or capsule ; seeds 2—4.

XXXIII. *Solanaceæ* (*Lycium*).—Leaves alternate or fasciculate. Stipules 0. Flowers regular, pentamerous. Calyx gamosepalous. Ovary free. Fruit a berry. Seeds many.

XXXIV. *Scrophulariaceæ*.—Leaves opposite or alternate. Stipules 0. Flowers bisexual, irregular, more or less bilabiate. Stamens 2 or 4, in the latter case didynamous. Fruit a capsule. Seeds numerous.

XXXV. *Orobanchaceæ* (*Cistanche*).—Leaves reduced to fleshy scales. Flowers zygomorphic Calyx 4-5-lobed. Corolla tubular, 5-lobed. Stamens 4, didynamous. Ovary 1-celled. Capsule 2-valved. Seeds numerous. Parasitic plants, destitute of chlorophyll.

XXXVI. *Bignoniaceæ*.—Leaves opposite, compound ; leaflets opposite. Stipules 0. Flowers bisexual, zygomorphic. Calyx gamosepalous. Ovary free, supported by an annular disk. Fruit a capsule.

XXXVII. *Acanthaceæ*.—Leaves opposite. Stipules 0. Flowers bisexual, mostly irregular. Ovary free, 2-celled ; style filiform, bifid, one branch often obsolete. Capsule loculicidal. Seeds often clothed with white elastic hairs, seated on hard curved supports.

XXXVIII. *Verbenaceæ* (*Bouchea*).—Leaves opposite or sub-opposite. Stipules 0. Flowers bisexual, zygomorphic. Calyx gamosepalous, persistent, at length splitting longitudinally to the base, lobes 5, imbricate. Corolla with 5 subequal lobes. Stamens 4, didynamous. Ovary 2-celled, 1-2 ovules in each cell.

XXXIX. *Labiataæ*.—Mostly aromatic. Branches usually 4-sided. Leaves opposite or whorled. Stipules 0. Flowers bilabiate. Calyx persistent. Corolla-lobes imbricate in bud. Stamens didynamous, the upper 2 sometimes imperfect or wanting. Ovary free, usually 4-lobed, supported by the annular disk. Fruit of 4 one-seeded nutlets.

### III.—MONOCHLAMYDEÆ.

Flowers frequently unisexual. Perianth as a rule simple. Rarely a distinct calyx and corolla.

XL. *Nyctaginaceæ* (*Boerhaavia*).—Leaves opposite, entire. Stipules 0. Flowers small, bisexual. Perianth small petaloid. Stamens 1, or 25

connate below. Ovary stipitate. Fruit indehiscent, enclosed in the persistent perianth tube.

XLII. *Illecebraceæ* (Cometes).—Leaves opposite. Stipules minute. Flowers 3 together, only the central one perfect, surrounded by ferruginous bracts. Perianth herbaceous, 5-partite. Stamens 5, alternating with staminodes. Utricle enclosed in perianth.

XLIII. *Amarantaceæ*.—Leaves alternate or opposite, entire. Stipules 0. Flowers usually bisexual. Perianth of 5 persistent sepals, imbricate in bud. Stamens opposite the sepals. Ovary free, 1-celled. Seed 1; embryo horseshoe-shaped or annular.

XLIII. *Chenopodiaceæ*.—Leaves alternate, rarely opposite, simple. Stipules 0. Flowers small, usually green, bi- or uni-sexual. Perianth of 3-5 sepals. Stamens opposite the sepals. Fruit a utricle, generally enclosed in the perianth. Seed 1; embryo curved, annular, or spiral.

XLIV. *Aristolochiaceæ*.—Leaves alternate. Stipule 0. Flowers bisexual. Perianth inflated below, with a trumpet-shaped mouth. Ovary inferior; placentas parietal. Ovules numerous. Capsule 12-ribbed.

XLV. *Loranthaceæ*.—Parasitic on stems and branches. Leaves opposite, sub-opposite or alternate. Flowers regular, in 4-6-flowered umbels. Perianth double. Stamens equal to and opposite the petals. Ovary inferior, 1-celled; ovule 1. Fruit baccate.

XLVI. *Euphorbiaceæ*.—Leaves in most genera alternate, undivided and stipulate. Flowers as a rule unisexual. Perianth calycine, some genera with petals. Ovary superior, as a rule of 3 carpels, more or less united. Styles 3. Ovules 1 or 2 in each cell, pendulous from the inner angle.

XLVII. *Urticaceæ* (Forskohlea).—Leaves alternate, dentate. Stipules lateral, free. Flowers unisexual, monoecious, aggregated. Perianth 3-lobed in male flowers, absent in female. Stamen 1. Achenes enclosed in involucre, enveloped in wool.

#### *Second Sub-class—Monocotyledons.*

Embryo with a single cotyledon. Vascular bundles arranged in a scattered manner in the stele, without cambium. Foliage leaves usually with parallel venation.

XLVIII. *Hydrocharitaceæ* (Halophila).—Salt-water herbs. Leaves in pairs or solitary, undivided. Flowers 1-sexual, monoecious, enclosed in spathes. Male flowers: sepals 3, stamens 3. Female flowers: sepals 3, petals 0. Fruit a beaked utricle.

XLIX. *Scitamineæ* (Musa).—Easily recognized by the enormously long leaves, which reach several feet.



L. *Amaryllidaceæ*.—Flowers bisexual, epigynous. Perianth hexamerous, petaloid. Stamens 6. Ovary of 3 carpels, trilocular. Fruit a loculicidal capsule.

LI. *Liliaceæ*.—Flowers bisexual. Perianth in 2 series, imbricate in bud, hypogynous. Stamens 6. Ovary 3-celled; style 1. Ovules attached to the inner angle of the cells.

LII. *Commelinaceæ* (Commelina).—Flowers hypogynous. Sepals 3, membranous. Petals 3, one larger. Stamens 3, perfect, and 2-3 imperfect. Ovary 3-celled.

LIII. *Palmae*.—Stem solid. Leaves pinnately or palmately divided. Inflorescence with sheathing bracts. Calyx and corolla of 3 segments each. Carpels 3.

LIV. *Naiadaceæ* (Cymodocea).—Submerged marine plants. Leaves with stipular sheaths. Flowers unisexual or bisexual. Perianth 0. Male flowers with 2 stamens. Female flowers: 2 carpels, 1 ovule. Fruit of 2 ovoid carpels.

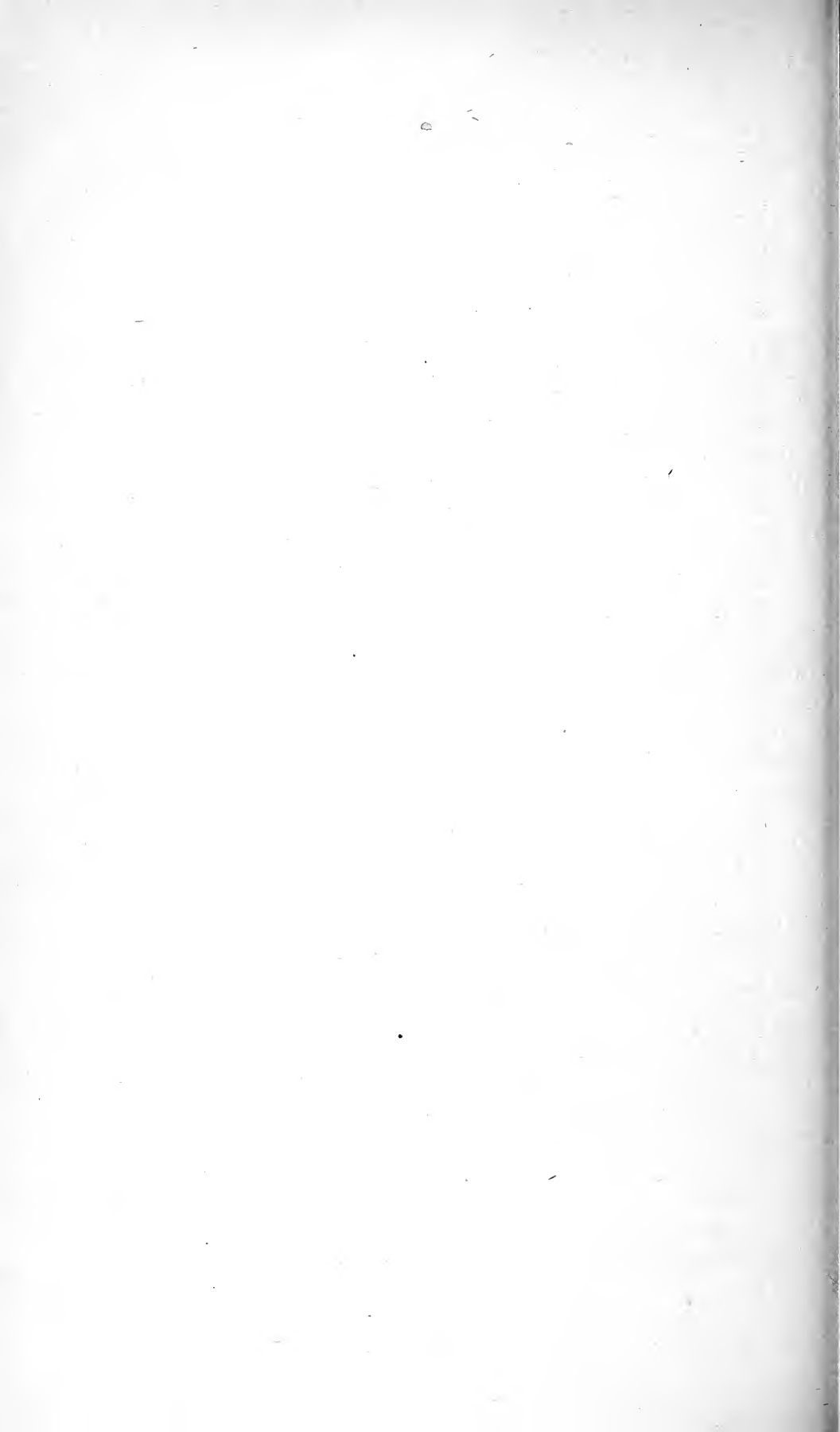
LV. *Cyperaceæ*.—Flowers hypogynous, usually diclinous. Stamens 3. Ovary di- or tri-merous, unilocular. Fruit an achene; pericarp not adherent to seed. Tubular leaf-sheaths; stem usually angular and solid.

LVI. *Gramineæ*.—Flowers hypogynous, usually bisexual, surrounded by pales and lodicules. Stamens usually 3; anthers versatile. Ovary monomerous, unilocular. Fruit a caryopsis with an inseparable pericarp. Stem usually hollow.

### *Second Class—Gymnosperms.*

Flowers unisexual. Perianth none or incomplete. Ovules free, not enclosed in an ovary, fertilized by the pollen tube entering the micropyle or a tube formed by the integument. Seeds naked; embryo straight with copious endosperm.

LVII. *Gnetaceæ* (Ephedra).—Climbing shrubs. Dioecious or monoecious. Branches often fascicled. Male flowers in short bracteate spikelets, which are in pairs or 3 together; perianth of 2 sepals. Female flowers consisting of 1 ovule with a single integument. Fruit fleshy with 2 seeds.



## II.—DESCRIPTION OF SPECIES.

### I.—MENISPERMACEÆ.

Scandent or twining shrubs, with palmate or peltate alternate leaves, without stipules.

Flowers dioecious, rarely perfect or polygamous. Sepals usually 6 (rarely 1—4 or 9—12), imbricate in two series. Male flowers: Stamens hypogynous, equal in number and opposite to the petals; filaments free or connate. Female flowers: Staminodes 6 or 0. Ovaries usually 3.

Ripe carpels drupaceous. Seeds usually hooked or reniform, often curved by an intrusion of the endocarp.

*Genera* 62; *species* about 100.

*Distribution*: Chiefly in the tropics of both hemispheres.

#### 1. *Cocculus* DC.

Climbers or rarely nearly erect.

Flowers in axillary panicles. Sepals 6, in two series, 3 inner larger. Petals 6, shorter than the inner sepals. Male flowers: Stamens 6, free, with 4-lobed anthers. Female flowers: Staminodes 6 or 0. Ovaries 3; styles usually cylindric.

Drupe rotundate or obovate, compressed. Putamen tuberculate or transversely rugose. Seed horseshoe-shaped; embryo with linear, appressed cotyledons in few fleshy albumen.

*Species* about 18.

*Distribution*: All warm climates.

#### 1. *Cocculus Cebatha* DC. Syst. I (1818), 527; Prodr. I (1824) 100.

*Cocculus pendulus* (Forst.), Diels, Pflanzenf. IV, 94.

*C. Leäba* DC. Syst. I (1818) 529; Prodr. I (1824) 99; A. Rich. Fl. Seneg. I (1831) 13; Hook. Niger Fl. (1849) 97; Miers in Contrib. Bot. III (1871) 256; Oliver Fl. Trop. Afr. I (1868) 44; Hook. f. et Thoms. Fl. Ind. (1855) 192; Hook. Fl. Brit. Ind. I (1872) 102; Volkens, Fl. Aeg.-Arab. Wüste (1887) 86.

*C. ellipticus* DC. Syst. I (1818) 256; Prodr. I (1824) 100.

*C. Epibaterium* DC. Syst. I. (1818) 530; Prodr. I (1824) 100.

*C. lævis* Wall. Cat. 4975 (1828).

*C. glabra* W. & A. Prodr. I (1834) 13; Miers in Contrib. Bot. III (1871) 257.

*C. recisus* Miers in Ann. Nat. Hist. 3. ser. XIX (1867) 24 n. n.; Contrib. Bot. III (1871) 258.

*Leæba* Forsk. Fl. Aeg.-Arab. (1775) 172.

*Leæba dubia* Gmel. in Linn. Syst. Nat. II (1791) 567.

*Cebatha* Forsk. Fl. Aeg.-Arab. (1775) 171.

*Cebatha edulis* Forsk. ex Vahl Symb. Bot. I (1790) 80.

*Cebatha pendula* O. Ktze Rev. Gen. I (1891) 9; Hiern in Welw. Pl. Afr. I (1896) 18.

*Epibaterium pendulum* Forst. Gen. (1776) 108, tab. 54.

*Menispermum edule* Vahl Symb. Bot. I (1790) 80; Lam. Dict. IV (1797) 99; Willd. Sp. Pl. IV (1805) 828.

*Menispermum leæba* Delile in Descript. Egypt. t. 31, f. 2, 3 (1813).

*Menispermum ellipticum* Poir. in Lam. Encyl. XI [Suppl. III.] (1813) 657.

*Adenocheton phyllanthoides* Fenzl in Flora XXVII (1844) 312.

*Bricchettia somalensis* Pax in Ann. Ist. Bot. Roma VI (1897) 181.

*Arabic name*: Turrâch, ssaq-el-ghorab (Schweinf.).

*Description*: A scandent shrub with slender glabrous or glabrate, striate, pale or ashen, leafy branchlets. Leaves small, rather coriaceous, lanceolate-oblong or lanceolate-ovate or obtusely trapezoidal, entire or sometimes obscurely lobed, mucronate, cuneate or rather rounded at the base, more or less glaucous,  $\frac{1}{2}$ -1 $\frac{1}{2}$  inches long,  $\frac{1}{2}$ - $\frac{3}{4}$  inch broad; petioles hairy.

Flowers axillary, small, inserted in a hairy tubercle, the males clustered in dense axillary fascicles, the females solitary, rarely twin. Petals of the male flowers deeply and acutely emarginate, with 2 lateral lobes embracing the stamens. Ovaries 3.

Drupe obovoid, keeled, compressed; style-scar basal.

*Flowers*: January 1880 (Balfour), November (Schweinf.).

*Locality*: Valley north of the Shum Shum Range above Maala village, plain of Maala, scandent on *Salvadora* (Defl., Schweinf.); without locality (Birdw., Perry).

*Distribution*: Gujarat, Sind, Punjab, Afghanistan, Central and Southern Africa, Socotra, Abyssinia, Kordofan, Eritrea, Nubia, Egypt, Senegambia, Cape Verd Islands.

*Uses*: According to Forskal the Arabs prepare a liquor from the fruit of this plant which they call 'Chamr el madjnûne'.

*Note*: *Cocculus Cebatha* is a very variable plant and it has puzzled many a botanist who collected at Aden.

Deflers mentions in one of his lists a *Cocculus* sp. giving the following description: "On the 30th April this liana showed neither flowers nor fruits. Judging from its habit it may be considered as a

*Cocculus* nearly allied to *C. Leæba*. I found only one specimen rising on a trachytic escarpment to a height of 26—33 feet. This plant which is growing very vigorously has a stem of  $2\frac{2}{5}$  inches in diameter. The branches are voluble, the bark glabrous and grey-yellowish striate. The leaves are glabrous, peltate, entire, oval, obtuse, mucronate, of variable dimensions. The limb of the best developed leaf is  $3\frac{1}{5}$  inches long and  $2-2\frac{2}{5}$  inches broad, the petiole measuring 1 inch."

Faurot collected a similar plant near the Gulf of Tadjurah of which Franchet gives us the following characteristics: "A single branch, sterile; the leaves are very glaucous, soft, puberulous, peltate, truncate at the base, rounded or obscurely pentagonal, 3—5 lobed, terminal triangular; it does not belong to any of the known species of Menispermaceæ growing in that region. The Somalis use the root as food and they call it 'gara.'" <sup>1</sup>

Also Birdwood's herbarium contains some bits of a plant which differ in many respects from the typical *Cocculus Cebatha*. When preparing my former list of Aden plants I considered the specimen as a different species, but for want of sufficient material I was not able to specify it.

The observations made by Schweinfurth in Eritrea and Nubia make it very probable that all these doubtful specimens are only different forms of the same species *Cocculus Cebatha* DC. (= *leæba* DC.). He writes: "The specimens from Saati (Eritrea) are young branches of a 2 or 3 year old plant which, at this age, always produces long twining shoots with large, broadly ovate, rounded triangular or three-lobed leaves. These leaves are short-peltate at the base, 5-nerved and have in consequence of this, quite a different aspect from all the specimens of a fully developed shrub, and one might be tempted to suspect a new species of Menispermaceæ, if there were not some transition forms. A. Defflers collected in 1886 (Soc. Bot. de France 1887, p. 64) a *cocculus* on the Shum Shum Range of Aden, whose branches combine the elliptical leaves of *C. leæba* with the broadly ovate peltate leaves of the juvenile form mentioned above. The analogy with the hastate and 3-lobed leaves which always occur in young specimens of *C. villosa* DC. is evident; the only difference is that they are never found in old plants. During my former visits to S. Nubia I had the opportunity of observing various forms of leaves on juvenile specimens, similar to those which occur on *C. villosa*, viz., cordate-3-lobed, 5-nerved, with peltate attachment of the blade to the petiole. The light-grey colour is constant." <sup>2</sup>

<sup>1</sup> Franchet, A. Plantes du Voyage au Golfe de Tadjourah recueillies par M. L. Faurot, in Journal de Botanique, Vol. I (1887), p. 118.

<sup>2</sup> Schweinfurth. Sammlung arabisch-äthiopischer Pflanzen. Bulletin de l'Herb. Boissier 1894. Append. II.

## II. CRUCIFERÆ.

Herbs, sometimes shrubby, with colourless often pungent juice, glabrous, glaucous, or with simple mediofixd or stellate hairs. Leaves simple, alternate, exstipulate.

Flowers racemose or corymbose at first, rarely bracteate. Sepals 4, deciduous, imbricate or valvate in the bud. Petals 4, stalked, arranged in the form of a cross, alternating with the sepals. Stamens tetradynamous. Ovary solitary, 2-locular by a spurious dissepiment extending across from the middle-line of the two parietal placentas; stigmas 2, sessile, opposite the placentas.

Fruit a siliqua or silicula, usually 2-locular by the replum, from which the valves separate in dehiscence, leaving the placentas on a frame. Seeds generally pendulous in a single row on each placental margin; embryo with the radicle variously folded on the cotyledons, without perisperm.

*Genera* about 170; *species* about 1,200.

*Distribution* :—All temperate and cold regions. A few genera are peculiar to the southern hemisphere

Leaves linear, entire, with appressed mediofixd hairs . . . . .	1. <i>Farsetia</i> .
Radical leaves lyrate or pinnatifid . . . . .	2. <i>Diploaxis</i> .

### 1.—*Farsetia* Desv.

Branched herbs or undershrubs, often hoary with appressed hairs. Leaves linear or narrow, entire.

Flowers spikate or racemose. Sepals erect, the lateral slightly saccate. Petals with long claws.

Siliqua various in outline, from linear to orbicular, flat-compressed or turgid, with plane or convex, nerved or nerveless valves; septum membranous, veined. Seeds compressed, often winged, in 1 or 2 series. Cotyledons accumbent.

*Species* about 20.

*Distribution* :—Southern Europe, North Africa, Asia Minor, Persia, Arabia, Socotra.

1. *Farsetia longisilqua* Dene. Ann. Sc. Nat. Ser. II. IV, 69; Walp. Repert. I, 139; Journ. Bull. Soc. Bot. Fr. XI, 56; Coss. Comp. Fl. Atlant. II, 227; Oliv. Fl. Trop. Afr. I, 62.

*Farsetia stylosa* Anders. Journ. Linn. Soc. V, Suppl. p. 1.

*Mathiola stylosa* Hochst. et Steud. in Schimp. Pl. Arab. Fel. n. 860.  
*Arabic name* : Hamma.

*Description* :—Suffruticose, hoary with closely appressed white hairs ; branches slender, rather rigid, divaricate. Leaves very narrow-linear.

Flowers bright rose, rather distant, in narrow, spicate racemes ; buds oblong. Pedicels at length 1—2 lines long, appressed or ascending.

Siliquas 1 inch long more or less, slightly curved outwards, linear,  $1\frac{1}{4}$ - $1\frac{1}{2}$  lines broad ; valves hoary, undulate, with a faint midrib. Persistent style about 1 line long.

Balfour found in Socotra "flowers varying in colour from a pink to that livid or violate shade seen in, for example, the common *Malcolmia maritima*."

*Flowers* :—March (Schweinf.).

*Fruits* :—December (Schweinf.).

*Locality* :—Goldmore Valley (Schweinf., Deff.) ; without locality (Hook., Birdwood, Hildebr.).

*Distribution* :—Central and Southern Arabia, Socotra, Eritrea, Nubia, Upper Egypt.

*Note*.—*Farsetia longisiliqua* Dene, is distinguished from *F. Hamiltonii* Royle (Illustr. 71) by its much larger flowers, pods, and non-capitate stigmas. *F. linearis* Dene. is separated from *F. longisiliqua* by its smaller flowers and shorter and relatively broader pods.

## 2. *Diplotaxis* DC.

Herbs resembling *Brassica* with regard to the general aspect and only distinguishable by the more distinctly biseriate seeds.

Sepals at length spreading.

Siliquas linear, sometimes elongate, compressed, without or sometimes with a short 1-seeded beak ; valves with a median nerve ; septum membranous. Seeds many, biseriate, ellipsoidal or globose. Cotyledons conduplicate.

*Species* about 20.

*Distribution* :—Western Asia, Northern Africa, Europe.

**1 *Diplotaxis pendula*** (Vahl) DC. Syst. Veg. II, 630 ; Prodr. I, 222 ; Anders. Journ. Linn. Soc. V, Suppl. p. 2 ; Aschers. et Schweinf. Suppl. Fl. d' Eg. p. 75 ; Batt. et. Trab. Fl. d' Alg. p. 63.

*Sisymbrium pendulum* Desf. Fl. Atl. II, 82, t (t.) 156.

*Sisymbrium hispidum* Vahl Symb. II, 77.

*Diploaxis harra* Boiss. Fl. Or. I, 388, Aschers. et Schweinf. Fl. d' Eg. p. 41.

*Diploaxis crassifolia* DC. Syst. Veg. II, 629.

*Diploaxis hispida* DC. Syst. Veg. II, 630.

*Description* :—Leaves obovate, lanceolate, coarsely dentate, hispid. Corolla large, yellow ; sepals ovate, tomentose.

Siliquas pedicellate, pendulous, glabrous, linear, attenuate at the base ; style very short ; stigma bilabiate.

This plant varies a good deal with regard to the hairiness of its leaves. With the exception of corolla and siliqua, the plant is mostly hispid.

*Locality* :—Near the Shum Shum Flag Staff (Defl.) ; top of the Shum Shum Range (Busse) ; without locality (Hook. Birdwood).

*Distribution* :—Arabia, S. Persia, Syria, Palestine, Egypt, Tripoli, Tunis, Algeria, Morocco, Sicily, S. Spain.

### III.—CAPPARIDACEÆ.

Herbs, shrubs or trees, often scandent. Leaves alternate, rarely fasciculate, simple or 3-7-foliate ; stipules, when present, minute or represented by short spines.

Flowers regular or the sepals or petals sometimes unequal, rarely polygamous. Sepals 4, rarely 3 or 5, valvate, imbricate or open in aestivation. Petals usually 4, sessile or clawed, hypogynous or seated on the disk. Stamens inserted at the base or apex of the torus, few or very many ; anthers oblong, basifixed. Ovary sessile, or with a long or short stalk (gynophore), 1-celled ; ovules numerous, on 2-4 parietal placentas.

Fruit capsular or baccate, or dry and indehiscent, rarely drupaceous. Seeds reniform or angled, albumen thin or none ; embryo incurved.

*Genera* 23 ; *species* about 300.

*Distribution* :—Chiefly in tropical but also in subtropical countries of both hemispheres.

Herbs ; fruit capsular . . . . . 1. Cleome.

Undershrub ; fruit with membranous wing, indehiscent,

1—seeded . . . . . 2. Dipterygium.

Trees or shrubs ; fruit berried or capsular :—

(a) Sepals combined at the base into a tube . . . . . 3. Maerua.

(b) Sepals biseriate :—

\* Stamens 4—6, inserted half way up the gynophore . . . . . 4. Cadaba.

\*\* Stamens 8—∞, inserted at the base of the gynophore . . . . . 5. Capparis.



### 1. *Cleome* Linn.

Herbs or shrubs, rarely subarborescent, glabrous, glandular, scabrous or aculeolate. Leaves simple or 3-9-foliate; leaflets entire or serrulate.

Flowers racemose or solitary and axillary. Sepals 4, spreading. Petals 4, subequal, sometimes subunilateral. Stamens 4-20, all or two or more anther-bearing, inserted upon the torus, free or very shortly coherent at the base. Ovary sessile or stipitate, 1-celled; ovules indefinite on 2 parietal placentas.

Capsule linear, oval or ellipsoid, sessile or stipitate, 1-celled, with membranous or rather coriaceous valves separating from a persistent replum. Seeds indefinite, reniform or globose-reniform; cotyledons incurved or circinate.

*Species* about 70.

*Distribution*:—In tropical and subtropical countries both of the Old and New World.

#### A. Leaves simple:—

##### 1. Style short, $\frac{1}{2}$ — $\frac{3}{4}$ inch long:—

- |   |                              |
|---|------------------------------|
| a. Bracts minute or absent . . . . .                      | 1. <i>C. quinquenervia</i> . |
| b. Bracts only slightly smaller than the leaves . . . . . | 6. <i>C. brachystyla</i> .   |
| c. Bracts small, sessile . . . . .                        | 2. <i>C. papillosa</i> .     |

##### 2. Style long, $\frac{1}{2}$ — $\frac{3}{4}$ inch:—

- |                                      |                             |
|--------------------------------------|-----------------------------|
| a. Leaves ovate-cordate . . . . .    | 5. <i>C. pruinosa</i> .     |
| b. „ cordate-suborbiculate . . . . . | 7. <i>C. polytricha</i> .   |
| c. „ orbiculate . . . . .            | 8. <i>C. droserifolia</i> . |

#### B. Leaves compound:—

- |   |                            |
|---|----------------------------|
| 1. Capsule oval or elliptical, 2—4 lines long . . . . . | 3. <i>C. brachycarpa</i> . |
| 2. Capsule linear, 4 inches long . . . . .              | 4. <i>C. paradoxa</i> .    |

**1. *Cleome quinquenervia* DC. Prodr I, 239; Anders. Journ. Linn. Soc. V, Suppl. p. 3; Boiss. Fl. Or. I, 415; Cooke Fl. Bomb. Pres. I, 37.**  
*Cleome pentanervia* Ait. Cat. Pb. and Sind Pl. p. 9.

*Description*:—Glaucous, 6-12 inches high, the whole plant covered with glandular hairs; branches many from a woody base, rigid. Leaves  $\frac{1}{2}$ -1 inch in diameter, ovate or suborbicular, subcordate, palmately 5-nerved from the base, margins ciliate with glandular hairs.

Flowers pale pink in the axils of leafy bracts on short racemes; bracts ovate, acute, subsessile; pedicels slender,  $\frac{1}{4}$ — $\frac{3}{8}$  inch long. Sepals linear, acute, half as long as the petals, ciliate with glandular hairs. Petals ovate, acute, with a crested appendage across the inside or little above the base. Stamens 4.

Capsule 1—1 $\frac{1}{4}$  by  $\frac{1}{8}$ — $\frac{1}{6}$  inch, narrow-oblong, acute at both ends, straight or slightly curved, rough with short, thick glandular hairs. No gynophore. Seeds minute, numerous, smooth, brown.

*Locality* :—Sandy places near the sea-shore (Madden) ; without locality (Birdw., Balf.).

*Distribution* :—S. Arabia, S. Persia, Afghanistan, Sind.

**2. *Cleome papillosa*** Steud. Nom. Bot. ed. 2, I, 382 ; Anders. Journ. Linn. Soc. V, Suppl. p. 3 ; Boiss. Fl. Or. I, 413 ; Hook. Fl. Brit. Ind. I, 168 ; Oliv. Fl. trop. Afr. I, 76 ; Cooke Fl. Bomb. Presid. I, 36.

*Cleome gracilis* Edgew. in Journ. Asiat. Soc. Beng. XVI, 1212.

*Cleome scaposa* DC. Prodr. I, 239.

*Cleome Ehrenbergiana* Schweinf. Fl. Aethiop. p. 68.

*Cleome radula* Fenzl. in Flora 1844, p. 312.

*Cleome cordata* Ehrenbg. ined. in herb. arab.

*Cylindrocarpus cordata* Kl. ined. ibidem.

*Description* :—A low scabrous or hispid herb, 4–12 inches high, usually with several erect or ascending slender stems more or less leafy below. Radical leaves ovate to orbicular, shortly hispid-scabrous, entire,  $\frac{1}{3}$ –1 inch in diameter, petiolate ; cauline leaves often cordate at the base, shortly petiolate or sessile.

Flowers small, pink, in long slender, bracteate, racemes ; pedicels filiform ; bracts small. Sepals linear-lanceolate, glandular. Petals clawed. Stamens 6.

Capsules glabrous or slightly papillose, striate, very slender,  $\frac{3}{4}$ –1 $\frac{1}{2}$  inches by  $\frac{1}{32}$  inch. Gynophore almost 0. Seeds minute, brown-black, glabrous, granulate.

*Flowers* :—March 1878 (Perry).

*Fruits* :—December (Herb. Kew).

*Locality* :—Near the Telegraph Office, valley near Steamer Point. (Schweinf.) ; Goldmore Valley (Defl.) ; without locality (Edgew., Anders., Birdw., Marchesetti, Wichura, Hildebrandt, Perry).

*Distribution* :—Kordofan, Nubia, Abyssinia, Somaliland, Eritrea, extending through Arabia to N. W. India, Sind, Socotra.

**3. *Cleome brachycarpa*** (Forsk.) Vahl in DC. Prodr. I, 240 ; Anders. Journ. Linn. Soc. V, Suppl. p. 4 ; Boiss. Fl. Or. I, 412 ; Hook. Fl. Brit. Ind. I, 169 ; Oliv. Fl. trop. Afr. I, 77 ; Franch. Sert. Somal. in Miss. Révoil p. 11 ; Terrac. in Ann. Inst. Bot. Rom. V, 113.

*Cleome ornithopodioides* Forsk. Fl. Aeg.-Arab. Cat. n. 402.

*Cleome Vahliana* Fresen. Mus. Senckenb. II, 110 ; Ait. Cat. Pb. and Sind Pl. p. 9.

*Cleome ruta* Cambess. in Jacq. Voy. Bot. p. 19, t. 19 ; Ait. Cat. Pb. and Sind Pl., p. 9.

*Cleome diversifolia* Hochst. et Steud. in Schimp. Fl. Arab. Fel. n. 762.

*Cleome parviflora* R. Br. in Salt-Voy. Abyss. p. 65.

*Arabic name* : Chosam.

*Description* :—A low diffuse perennial herb, 6-18 inches high, more or less glandular-pubescent or scabrid-setulose, sometimes glabrescent, with an odour of rue. Leaves 3-5-1-foliolate, petiolate or the upper sessile; leaflets oblanceolate or oblong, acute or obtuse and mucronate, viscidly puberulous.

Flowers yellow, in the axils of leafy bracts, in lax racemes; pedicels  $\frac{3}{8}$ — $\frac{1}{2}$  inch long, filiform; bracts 3-foliolate or simple, subsessile. Sepals  $\frac{1}{10}$  inch long, ovate-lanceolate, much shorter than the petals, glandular pubescent outside. Petals  $\frac{1}{4}$ — $\frac{3}{8}$  inch long, ovate-oblong, subacute, glabrous, furnished inside with a small scale-like appendage above the short claw. Stamens 6, of which one is sometimes imperfect. Ovary minutely glandular or glabrous, sessile. Style slender.

Capsule  $\frac{3}{8}$ — $\frac{1}{2}$  by  $\frac{1}{10}$ — $\frac{1}{8}$  inch, oblong, inflated, glandular. No gynophore. Seeds minute, nearly smooth.

*Flowers and fruits* in January in Yemen (Schweinf.).

*Locality* :—On the slope of the Shum Shum Range (Edgew., Madden, Hook., Anders., Zenker, Hildebrandt, Balf., Marchesetti, Ellenbeck, Busse); near Maala (Schweinf.); without locality (Birdw., Kuntze).

*Distribution* :—Kordofan, Abyssinia, Nubia, Somaliland, Socotra, Central and S. Arabia, Punjab.

*Uses* :—The strongly aromatic leaves of this plant are often sold in the market of Aden. They are put between clothes in order to protect them against insects (Krause).

4. *Cleome paradoxa* R. Br. in Salt Voy. Abyss. App. p. 65; DC. Prodr. I, 241; Anders. Journ. Linn. Soc. V, Suppl. p. 2; Oliv. Fl. trop. Afr. I, 78.

*Cleome venusta* Fenzl. in Flora (1844) p. 312.

*Cleome muricata* Edgew. Journ. Asiat. Soc. Beng. XVI, 1212.

*Dianthera grandiflora* Kl. in Peter's Reise nach Mozamb., Bot. I, 161.

*Cleome grandiflora* Ehrbg. ined. in herb. arab. et abyss.

*Description* :—An erect, somewhat shrubby plant of 2-3 feet; the branches simple or forking, leafy, glabrous or with dark sessile glands above. Leaves 3—6-foliolate; leaflets linear or linear lanceolate, glabrous, glaucescent.

Flowers on terminal racemes, pedicellate, rather large, citron-yellow or rose, closely corymbose at first. Bracts linear or obsolete. Sepals ovate or ovate-lanceolate, often glandular. Petals unequal. Stamens 6, 2 usually much longer; anthers purple (Schweinf.).

Fruits widely spreading or pendulous, linear, tapering to each end, about 4 inches long, 2—3 lines broad. Gynophore  $\frac{1}{2}$ — $\frac{3}{4}$  inch long. Style persistent, short, tapering, many times shorter than the glabrous striate valves. Seeds biseriate, subglobose, shortly pilose. Cotyledons circinate.

*Flowers* in October (Marchesetti).

*Fruits* from November to March (Schweinf.).

*Locality*:—Near the coal depôt of the Messag. Marit., on rubbish and loose rocky ground in great quantities (Schweinf.); ravine south-west of the tower of silence in the crater of the Shum Shum Range, plain of Maala (Defl.); on the slope of the Shum Shum on coarse gravel (Ellenbeck, Lunt); without locality (Edgew., Hook., Madden, Anders., Birdw., Hildebrandt, Marchesetti, Kuntze).

*Distribution*:—S. Arabia, Nubia, Abyssinia, Kordofan.

**5. *Cleome pruinosa*** Anders. Journ. Linn. Soc., V, Suppl. p. 3; Defl. Bull. Soc. Bot. Fr. XXXII, 346; Schweinf. Herb. Boiss. (1896) Append. II, 189; Franchet Journ. de Bot. I (1887) 40.

*Description*:—A small undershrub, stem much-branched, subglabrous; branches pruinose, with patent subhirsute pilose hairs, leafy. Leaves long-petioled, 4—8 lines long, 3—6 lines broad, ovate, acuminate, 3-nerved, sparingly scabrous-papillose, margin glandular, subserrate; petiole  $\frac{3}{4}$  inch long.

Flowers axillary, solitary, usually greenish-yellow; sepals lanceolate, subglandular; petals linear, unguiculate, the posterior ones sometimes with red nerves, in other cases quite yellow. Stamens 4; filaments purpurascens; anthers greenish-yellow with blackish margin. Style slender, glabrous, 4 lines long. Siliqua sessile, erect, glandular, terete, oblong, longitudinally sulcate, 8 lines long, apiculate with the persistent deflexed style.

*Flowers*:—Dec. 1847 (Hooker), Dec. 1888 (Schweinf.), January 1863 (Oliver & Cl.).

*Fruits*:—Nov. 1888 (Schweinf.), Dec. 1847 (Hooker), April 1861 (Thomson), June 1872 (Hildebr.), June 1878 (Perry).

*Locality*:—Near the Mosque Shaik Aidrus, plain of Maala, valley above the European cemetery of Steamer Point, dry, rocky and stony

places (Schweinf.) ; plain of Maala, ravine near Steamer Point (Defl.) ; on the slope of the Shum Shum Range (Ellenbeck) ; without locality (Hook., Anders., Thomson, Birdw., Perry, Marchesetti, Hildebrandt, Lunt) ; very common (Krause) ; copiosissime at Aden (Perrotet, Remy, Courbon).

This plant is endemic in Aden.

*Note* :—*Cleome pruinosa* approaches very nearly *Cleome droserifolia* Del., but it is more glaucous and often less glandular, or even glabrescent ; the shape of the leaves is slightly different ; instead of being rounded like those of *C. droserifolia*, they are prolonged into a very short point. In the form reported by Courbon the leaves are almost glabrous and nearly distinctly cordate.

**6. *Cleome brachystyla*** Defl. Bull. Soc. Bot. Fr. XXXIV, 65 ; Morot, Journ. de Bot. I, 39.

*Cleome hispida* Ehrbg. Herb. arab. ined., ex schedula herb. Parisiensis.

*Description* :—An undershrub,  $1\frac{1}{2}$ —2 feet high, densely and softly villose with glandular pilose hairs ; stem erect, ramose, multi-costate. Leaves 10-11 lines long, 8-10 lines broad, long-petiolate, broadly ovate, sub-cordate, 3-5-nerved.

Flowers in terminal, elongate, leafy racemes. Bracts small, sessile. Pedicels half as long as the bracts. Sepals linear-acute. Petals lanceolate, pale yellowish, by one half longer than the calyx. Stamens 4, exserted. Style  $\frac{1}{2}$ — $\frac{3}{4}$  lines long, straight, shortly thickened ; stigma rotundate, oblique, purpurascens.

Siliqua 4—5-times as long as the pedicel (12—15 lines), non stipitate, ovate-cylindric, sparingly hairy with small erect glandular aculei ; style persistent, shortly apiculate. Seeds small, smooth, yellow.

*Flowers and fruits* from November to March (Schweinf.).

*Locality* :—Above the coal depôt of the Messag. Marit., Goldmore Valley, on rocks (Schweinf.) ; Koosaf Valley, Goldmore-Valley (Defl.) ; without locality (Birdw., Courbon, Balansa).

*Distribution* :—Island of Ketumbal (17° N.L.), Shugra, Somaliland.

*Note* :—“ The specific name given by Ehrenberg is older than the one given by Defflers. But in addition to the fact that Ehrenberg did not furnish us with any description of the plant, it seems that several species have been distributed by the Berlin Museum under the name of *C. hispida*. The specimen received by the Paris Museum under that name is certainly *C. brachystyla* Defl.” (Franchet.)

**7. *Cleome polytricha*** Franch. in Morot Journ. de Bot. I, 41; Schweinf. Bull. Herb. Boiss. (1896), Append. II, 189.

*Cleome hispida* Deff. Bull. Soc. Bot. Fr. XXXII, 346 et XXXIV, 64 (non Ehrbg. in Herb. Mus. Paris.).

*Description*:—A robust undershrub,  $1\frac{1}{2}$  feet high, densely covered with pilose-setulose glandular hairs; stems erect, spreading ramose from the base. Leaves 6—10 lines long and broad, long petiolate, orbiculate-cordate (broadly ovate and subcordate at the base in Deflers' specimen), 3-nerved or obscurely 5-nerved; bracts only slightly smaller than the cauline leaves, reflexed, orbiculate, deeply and narrowly cordate, subsessile.

Flowers in terminal loose and very leafy racemes. Pedicels patulate,  $1\frac{1}{2}$ -2-times as long as the bracts. Sepals lanceolate, puberulous, long glandular. Petals slightly longer than the calyx, broadly lanceolate, pilose at the apex; ('squama margine undulato-crispa, nunc triloba' according to Franchet). Stamens 4, exserted. Style 2-2 $\frac{1}{2}$  lines long (7-8 mm. according to Franchet); projecting beyond the stamens; stigma ovate.

Capsule 10-12 lines long, 2 $\frac{1}{2}$ -3 lines broad, oblong-lanceolate (ovate in Deflers' specimen), non stipitate, ascendent on the patent peduncle, covered with spreading pilose hairs which bear a black gland at the apex. Style persistent, deflexed. Seeds small, glabrous, reniform, yellow.

This species is very easily distinguished amongst the long-styled *Cleomes* by the reflexed and almost sessile bracts which leave at their base a deep narrow opening for the peduncle.

*Fruits*:—Dec. 1888 (Schweinf.), August (Herb. Kew).

*Locality*:—Ravine above the European cemetery of Steamer Point, plain of Maala, Goldmore Valley (Schweinf.); plain of Maala, Goldmore Valley, between boulders (Deff.); without locality (Birdw., Courbon, Beaudoin).

*Distribution*:—Saihut on the Mahra Coast, Tadjura on calcareous ground (Boivin).

**8. *Cleome droserifolia*** Del. Fl. d'Eg. p. 250; DC. Prodr. I, 239; Boiss. Fl. Or. I, 415; Oliv. Fl. trop. Afr. I, 77.

*Cleome roridula* R. Br. in Salt Voy. Abyss. I, 77.

*Description*:—A much-branched and shrubby glandular-hispid herb of 3-10 inches. Leaves broadly ovate-rotundate, obtuse, with a more or less truncate triplinerved base, setose, hispid or scabrous,  $\frac{1}{4}$ — $\frac{1}{2}$  inch in diameter, equalling or usually shorter than their petioles.

Flowers axillary, pedicellate. Sepals glandular-setose. Petals somewhat lanceolate with a thickened scale-like appendage at the base. Stamens 4. Ovary oblong or oval, shortly and densely glandular, sessile or subsessile, with a very long slender style.

Fruit oval, 4-5 lines long, with setose-hispid concave valves. Seeds reniform-globose, rather compressed, minutely granular.

*Locality*:—Great valley between Steamer Point and town (Marchesetti).

*Distribution*:—Nubia, Abyssinia, Egypt, Sinai, Central and Southern Arabia.

*Note*:—Marchesetti is the only botanist who reported this species from Aden, and we have included it on his authority. As *Cleome pruinosa* Anderson and *Cl. quinquenervia* DC. resemble very much *Cl. droserifolia*, we are perhaps allowed to doubt the actual occurrence of *Cl. droserifolia* at Aden.

## 2. *Dipterygium* Dene.

A twiggy, divaricately-branched undershrub. Leaves small, petioled, scattered, ovate-oblong, acute, entire.

Flowers small, in long bracteate racemes; pedicels short, filiform. Sepals small, ovate, acute. Petals white, ovate, obtuse, shortly clawed. Stamens 6, equal. Ovary 1-celled; ovules 1-2, often 4-winged, the wings afterwards disappearing; style elongate; stigma capitate.

Fruit indehiscent, small, pendulous, ellipsoid, compressed, surrounded by a membranous wing, 1-seeded. Seeds erect, curved; cotyledons concave, embryo incumbent.

*Species*:—1.

*Distribution*:—Nubia, Abyssinia, Kordofan, Central and S. Arabia, N.-W. India.

**1. *Dipterygium glaucum*** Dene. in Ann. Sc. Nat. Ser. 2, IV, 67, tab. 3; Anders. Journ. Linn. Soc. V, Suppl. p. 1; Boiss. Fl. Or. I, 417; Hook. et Thoms. in Journ. Linn. Soc. V, 179; Oliv. Fl. trop. Afr. I, 70.

*Pteroloma arabicum* Hochst. et Steud. in Schimp. Pl. Arab. Fel. n. 851.

Character of the genus.

*Flowers*:—Dec. 1847 (Hooker), Dec. 1888 (Schweinf.), January 1863 (Oliver and Cl.), March 1878 (Perry), April 1861 (Thomson), May 1859 (Anderson).

*Fruits*:—Dec. 1888 (Schweinf.), January 1863 (Oliver and Cl.), Apl. 1861 (Thomson), Nov. 1884 (Beever).

*Locality*:—From the sea shore up to 1,000 feet of the Shum Shum Range (Hook., Anders.); on sand fields along the coast (Schweinf.); without locality (Birdwood, Hildebrandt, Lunt, Perry, Beever); near Shaikh Othman (Defl.).

### 3. *Maerua* Forsk.

Shrubs or small trees, destitute of spines, glabrous or pubescent. Leaves simple or trifoliate, often with minute setaceous stipules.

Flowers axillary, solitary or fascicled, or in terminal racemes or corymbs. Sepals 4, united at the base into a persistent infundibuliform tube forming a 4-lobed calyx. Petals 0 or 4, episepalous. Disk infundibuliform, lining the calyx-tube, elongated in the middle into a columnar obconic receptacle or torus equalling or slightly exceeding the calyx-tube. Stamens indefinite, inserted on the torus; filaments free or connate at the base. Ovary cylindrical, linear-oblong or ovoid, on a long gynophore, 1-2-celled; placentas 2-4, parietal or cohering in the middle; stigma sessile or subsessile.

Fruit baccate, the constrictions of the pericarp sometimes separating it into numerous 1-seeded segments. Seeds large, cotyledons fleshy, convolute.

*Species*:—About 20.

*Distribution*:—Tropical Africa, Arabia, W. India.

Not climbing—

Leaves coriaceous . . . . 1. *M. Thomsoni*.

Leaves succulent . . . . 2. *M. crassifolia*.

Climbing . . . . 3. *M. ovalifolia*.

#### 1. *Maerua Thomsoni* Anders. Journ. Linn. Soc. V, Suppl. p. 5.

*Description*:—A shrub, quite glabrous, virgate, leafy, cortex punctate; branches very few; leaves coriaceous, mucronate, short-petioled, those of the flowering branches fasciculate, oblong, on the other branches alternate, linear.

Flowers solitary, pedunculate. Calyx tubular, shortly 4-partite.

Fruit fleshy, stipitate, glabrous, torulose.

*Flowers*:—In February 1851 (Hook. f. and Thomson).

*Locality*:—Aden (Hook. f. and Thomson, Balfour, Kuntze).

Endemic in Aden.



**2. Maerua crassifolia** Forsk. Fl. Aeg.-Arab, p. 113; Aschers. et Schweinf. Fl. d' Eg., p. 43.

*Maerua uniflora* Vahl Symb. I, 36; DC. Prodr. I, 254; Oliv. Fl. Trop. Afr. I, 86.

*Arabic Name*: Sserk, Meru.

*Description*:—Branches smooth. Leaves about  $\frac{1}{2}$  inch long or less, succulent, cuneate-ovate or oval, somewhat retuse.

Peduncles 1-flowered, solitary, slender,  $\frac{1}{2}$  inch long. Calyx 4-fid, glabrous; tube urceolate, 4-gonous; segments oblong, obtuse, ciliate, reflexed. Corolla 0, Corona multifid. Stamens about 30. Ovary cylindrical, glabrous.

Fruit  $\frac{1}{2}$  inch in diameter.

*Flowers*:—Dec. 1888 (Schweinf.), Dec. 1889 (Defl.).

*Fruits*:—Dec. 1888 (Schweinf.).

*Locality*:—Shum Shum Range, plain of Maala (Schweinf.); without locality (Birdw.).

Little Aden, on the Jebel Ihsan (Defl.).

*Distribution*:—S. Arabia, Palestine, Egypt, Nubia, Libya, Kordofan, Senegambia.

**3. Maerua ovalifolia** Cambess. in Jacq. Voy. Bot. 1844, p. 23, t. 24.

*Maerua arenaria* Hook f. et Thoms. in Fl. Brit. Ind. I, 171; Trim. Fl. Cey. I, 58.

*Niebuhreria oblongifolia* Royle Ill. Him. Bot., p. 73.

*Capparis heteroclita* Roxb. Fl. Ind. II, 570.

*Description*:—A climbing shrub with divaricate branches; bark smooth, pale. Leaves 1-2 by  $\frac{5}{8}$ -1 inch, elliptic-oblong, obtuse or retuse, mucronate, glaucous, glabrous; petioles stout,  $\frac{1}{8}$ - $\frac{1}{4}$  inch long.

Flowers in corymbs, greenish-white, terminal or on lateral shoots; pedicels  $\frac{1}{2}$ - $\frac{3}{4}$  inch long, glabrous; bract 1 at the base of each pedicel, small, ovate, acuminate, rigid, yellow. Calyx-lobes ovate, acute,  $\frac{1}{2}$  inch long, hooded at the apex, with a short horn behind the hood and with a line of dense white pubescence on the margin. Calyx-tube  $\frac{1}{8}$  inch long, lined with an infundibuliform disk as long as the tube with truncate margins, the columnar torus slightly exceeding the calyx-tube. Petals ovate-lanceolate, acute, with slightly undulate margins, half as long as the calyx-lobes and alternate with them or nearly so, inserted on the margin of the cup-shaped disk. Stamens many, inserted on the torus. Gynophore  $\frac{3}{4}$  inch long. Ovary cylindric, truncate; style 0; stigma large.

Fruit pale brown, constricted between the seeds, forming an elongate twisted and knotted berry, each lobe or knot 1 seeded. Seeds brown, globose, echinate.

*Locality*: Aden (Birdw.).

*Distribution*: W. India.

#### 4. *Cadaba* Forsk.

Shrubs, unarmed or the desert species sometimes spinescent. Leaves simple, entire, glandular scabrid or glabrous.

Flowers in terminal corymbs or racemes or axillary. Sepals 4, free, biseriate. Petals 4 or 0, inserted on the torus, unguiculate. Stamens 4 or 5; filaments more or less adnate to the gynophore. Appendix springing from the base of the gynophore, tubular linguiform or ligulate. Ovary on a long gynophore, 1-2-celled. Stigma sessile or subsessile. Ovules indefinite.

Fruit cylindrical, terete or subtorulose or ellipsoidal. Seeds subglobose; testa cartilaginous; cotyledons convolute.

*Species* about 20.

*Distribution*:—Africa, Madagascar, Arabia, India, Islands of the Indian Ocean, Australia.

Petals 0. Stamens 5, adnate to base of gynophore—

- |  |                             |
|--|-----------------------------|
| (a) Glabrous . . . . .                   | 1. <i>C. rotundifolia</i> . |
| (b) Glandular-pilose or hispid . . . . . | 2. <i>C. glandulosa</i> .   |

Petals present. Stamens 4 or 5, adnate  $\frac{1}{2}$ - $\frac{1}{2}$  length of gynophore—

- |   |                           |
|---|---------------------------|
| (a) Glabrous or extremities minutely mealy ;          |                           |
| Stamens 4 . . . . .                                   | 3. <i>C. longifolia</i> . |
| (b) Mealy-puberulous at first ; stamens 4-5 . . . . . | 4. <i>C. farinosa</i> .   |

1. *Cadaba rotundifolia* Forsk. Fl. Aeg.-Arab. p. 68 ; DC. Prodr. I, 244 ; Boiss. Fl. Or. I, 418 ; Schweinf. Beitr. Fl. Aethiop. p. 66 ; Oliv. Fl. trop. Apr. I, 89.

*Strœmia rotundifolia* Vahl Symb. I, 19.

*Arabic name*:—Qadsab, qattab.

*Description*:—Extremities minutely puberulous. Leaves coriaceous, orbicular or rotundate, glabrous, with one or two pairs of the principal lateral veins from near the base, 1-1 $\frac{1}{2}$  inches in diameter ; petioles about  $\frac{1}{2}$ - $\frac{3}{4}$  inch long.

Flowers in terminal racemes. Bracts subulate or obsolete. Petals 0. Appendix about  $\frac{3}{4}$  inch long, ligulate, lamina elliptical, obtuse, folded back over its claw in the bud. Stamens 5 ; filaments adnate 1-2 lines

with the gynophore, which is at length  $\frac{1}{2}$ - $\frac{3}{4}$  inch long. Ovary 1-celled; placentas 2.

Fruit linear, dehiscing in 2 valves, about  $1\frac{1}{2}$  inch long. Seeds reniform.

*Flowers and fruits* in November (Schweinf.).

*Locality* :—Goldmore Valley (Schweinf.); without locality (Birdw., Balfour). Hinterland: In the plain between Shaikh Othman and Bir Ahmed (Defl.).

*Distribution* :—S. Arabia, Socotra, Eritrea, Nubia, Abyssinia, Somaliland, Kordofan.

2. *Cadaba glandulosa* Forsk. Fl. Aeg.-Arab. p. 68; DC. Prodr. I, 244; Anders. Journ. Linn. Soc. V, Suppl. p. 4; Boiss. Fl. Or. I, 418; Oliv. Fl. trop. Afr. I, 89.

*Stroemia glandulosa* Vahl Symb. I, 20.

*Cadaba monopetala* Edgew. Journ. As. Soc. Beng. XVI, 1212.

*Arabic name* :—Teneim.

*Description* :—A much branched shrub, glandular-pilose with short, spreading, viscid hairs. Leaves orbicular, obovate or broadly elliptical, with or without a mucro, more or less shortly glandular-hispid or sometimes scabrid, usually 3-6 lines in diameter, rarely twice as large.

Racemes few-flowered, terminating the branches and lateral shoots. Petals 0. Appendix  $\frac{3}{4}$ -1 inch long, ligulate, the lamina petaloid, oblong, obtuse or emarginate. Stamens 5, shortly adnate to the base of the gynophore. Ovary 2-celled, owing to the cohesion of the placental plates.

Fruit oblong-ellipsoidal,  $\frac{1}{2}$  inch long on a gynophore of  $\frac{1}{4}$ - $\frac{3}{4}$  inch.

*Flowers* :—February 1851 (Thomson), Oct. (Defl.), Nov. 1888 (Schweinf.).

*Locality* :—Goldmore Valley (Schweinf.); on the slopes of Shum Shum Range (Edgew., Hook., Hildebrandt, Marchesetti, Ellenbeck); plain of Maala at the foot of the Shum Shum (Defl.); gravelly slope quite close to the town (Busse); without locality (Birdw., Kuntze); common (Krause).

*Distribution* :—Central and Southern Arabia, highlands of Somaliland, Abyssinia, Nubia, Kordofan.

3. *Cadaba longifolia* DC. Prodr. I, 244; A. Rich. Tent. Fl. Abyss. I, 26, tab. 5; Anders. Journ. Linn. Soc. V, Suppl., p. 4; Schweinf. Beitr. Fl. Aethiop. p. 66; Oliv. Fl. trop. Afr. I, 90.

*Strœmia longifolia* R. Br. in Salt Abyss. n. 64.

*Cadaba scandens* Pax in Engl. Bot. Jahrb. XIV, 301.

*Description* :—A glabrous shrub or the extremities slightly mealy. Leaves coriaceous, linear-oblong or lanceolate or elongate-oval, obtuse or subacute, often with a fine mucro, usually from 1-1½ inches long and 3-6 lines broad; petiole 2-3 lines long.

Flowers in short terminal corymbs; bracts reduced to minute scales. Sepals brick-red on the inner side. Petals citron-yellow, narrow-oval or lanceolate, with long claws, rather exceeding the sepals. Appendix linear-lanceolate or oblanceolate, about as long as the sepals, open on the side towards the gynophore. Stamens 4; filaments adnate halfway up the gynophore or higher. Ovary minutely glandular, bilocular, at least partially.

*Flowers* :—November 1888 (Schweinf.), Dec. 1889 (Defl.), Febr. 1851 (Hooker), April 1861 (Thomson), June 1878 (Perry).

*Locality* :—Goldmore Valley (Schweinf., Defl.); plain of Maala (Schweinf.); slopes of Shum Shum Range (Marchesetti, Ellenbeck); without locality (Hook., Thomson, Anders., Birdw., Lunt, Perry, Kuntze).

*Distribution* :—S. Arabia, Somaliland, Socotra, Eritrea, Sennaar, Abyssinia.

*Note* : Like several other species of *Capparidaceæ* v.g. *Maerua oblongifolia* Rich, etc., this plant produces on certain long shoots quite narrow leaves with the nervation very indistinctly visible on their upper side. Schweinfurth observed the following forms of leaves on specimens collected in the Goldmore Valley: Oblong-elliptic, pointed at both ends ( $1\frac{4}{5} \times \frac{1}{2}$  inch), linear or linear-lanceolate with slightly obtuse apex ( $2\frac{4}{5} \times \frac{1}{4}$  inch), lanceolate ( $2\frac{1}{5} \times \frac{1}{2}$  inch).

**4. *Cadaba farinosa* Forsk.** Fl. Aeg.-Arab. p. 68; DC. Prodr. I, 244; Boiss. Fl. Or. I, 418; Oliv. Fl. trop. Afr. I, 89.

*Strœmia farinosa* Vahl Symb. I, 20.

*Streblocarpus Fenzlii* Parl. in Webb. Fragm. Fl. Aethiop. p. 24.

*Arabic name* : Assal, el-bejadd, gorrah, gorreh, sserah.

*Description* :—A shrub or occasionally arborescent, often densely branched, the extremities terete, and more or less hoary-mealy. Leaves coriaceous, oblong, oval-oblong or varying from lanceolate to oblanceolate-oblong, obtuse, emarginate or rarely somewhat mucronulate and acute, pale glaucous-green or whitish and mealy at first, at length glabrate, ½-2 inches long,  $\frac{1}{6}$ -1 inch broad, often very small and fascicled; petiole about 1 line, rarely 3-4 lines.

Flowers in short terminal racemes, or terminating short lateral branches. Bracts reduced to minute scales or obsolete, except the lowest, which is sometimes leafy. Petals 4, linear or narrow-oval, clawed, exceeding or equalling the sepals. Appendix tubular, obliquely open, and often toothed at the extremity, shorter than, or nearly equalling the sepals. Stamens 4-5; filaments adnate  $\frac{1}{3}$ - $\frac{1}{2}$  way up the gynophore. Ovary cylindrical, 1-locular, with 2 placentas. Stigma sessile.

Fruit patent, subterete or slightly torulose, 1-2 inches long, on a gynophore of  $\frac{1}{2}$ - $\frac{3}{4}$  inch or rather more. Seeds reniform-rotundate, compressed.

*Flowers and fruits* in Yemen from December to January (Schweinf.).

*Locality* :—Locality not named (Hildebrandt according to Krause).

This species is not represented in Birdwood's herbarium and Hildebrandt seems to be the only one who saw this plant in Aden.

*Distribution* :—Central and S. Arabia, Nubia, Abyssinia, Kordofan, highlands of Somaliland, Usambara, Kilimandjaro, Senegambia.

### 5. *Capparis* L.

Trees or shrubs, often climbing or sometimes prostrate, unarmed or with short, often recurved, stipular spines. Leaves simple, coriaceous or submembranous, rarely wanting.

Flowers usually hermaphrodite, solitary, racemose, corymbose or umbellate, axillary or terminal. Sepals usually 4, free or connate at the base, biseriate, imbricate, or the two exterior subvalvate. Petals 4, imbricate. Torus short. Stamens usually indefinite, inserted upon the torus at the base of the long gynophore. Ovary stalked, 1-4-celled; ovules many, on 2-6 parietal placentas; stigma sessile.

Berry stalked, globose or cylindric, often elongate, rarely dehiscent. Seeds many, embedded in pulp; testa crustaceous or coriaceous; embryo convolute.

*Species* about 150.

*Distribution* :—In both tropics and in the warmer regions of the Old and New World.

Leaves ovate to rotundate; anterior sepal galeate . . . 1. *C. galeata*.

Leafless, at least the flowering branches; anterior sepal saccate. 2. *C. decidua*.

1. *Capparis galeata* Fresen. Mus. Senckenb. II, 111; Anders. Journ. Linn. Soc. V, Suppl. p. 5; Schweinf. Beitr. Fl. Aethiop. p. 67; Boiss. Fl. Or. I, 421; Oliv. Fl. trop. Afr. I, 96.

*Capparis spinosa* L. var. *galeata* Hook. f. et Thoms. in Fl. Brit. Ind. I, 173.

*Capparis cartilaginea* Dene. in Ann. Sc. Nat. Ser. 2, III, 273.

*Capparis uncinata* Edgew. Journ. As. Soc. Beng. XVI, 1213.

*Arabic name*.—Assef, Kaber (Ibn-el-Beithar); Latssaf (ubique), nutssaf (in Hodjela according to Schweinf.).

*English name*: Caper.

*Description* —A glaucous, leafy, diffuse shrub; extremities pulverulent. Leaves thick, cartilaginous, ovate or rotundate, tipped with a more or less curved or hooked mucro, 1—3 inches long,  $\frac{3}{4}$ —2 inches broad. Stipules spinose.

Flowers solitary, axillary; peduncles stout, recurved in fruit. Sepals 4, the larger galeate. Petals roundish.

Fruit baccate, clavate-pyriform, 3—4 inches long, on stipes of about  $1\frac{1}{2}$ —2 inches. Seeds reniform.

*Flowers*: Sept. 1880 (Hunter), Nov. 1888 (Schweinf.).

*Fruits*: Dec. 1847 (Hooker), Nov. 1888 (Schweinf.).

*Locality*:—Between boulders on basaltic lava, forming dense bushes, above the coal depôt of the Messag. Marit. (Schweinf.); northern slope of the Shum Shum Range above Maala, Biggari Valley, ravine above the tanks (Defl.); between boulders near the tanks (Busse); the great valley between Steamer Point and the town (Marchesetti); without locality (Edgew., Hook., Anders., Birdw., Kuntze, Hunter, Hildebrandt); common (Krause).

*Distribution*:—Sinai, Egypt, Nubia, Abyssinia, Somaliland, Socotra, Sind, Zanzibar.

*Note*:—Most forms of the Aden plant, though showing sometimes flowers of smaller dimensions, agree with the type of *C. galeata* which is so very common all over the region of the Red Sea. The following forms of leaves have been recorded by Schweinfurth: orbicular-ovate ( $3 \times 2\frac{3}{5}$  inches) with a petiole of  $\frac{4}{5}$  inch in length, elliptical ( $1\frac{5}{4} \times 1$  inch). The leaves vary a good deal with regard to their shape, not only in Aden, but also in the neighbouring countries, but the plant never loses its characteristic habit: extremely thick coriaceous-cartilaginous leaves, ascending branches with regular zigzag turns, thickening of the branchlets which is quite out of proportion.

*Uses*:—This species yields a volatile oil which has the properties of garlic oil (Pharmacogr. Ind. I, 135).

The caper is mentioned by Greek and Latin writers and through them probably the medicinal properties of the root were made known to

the Arabs. It was generally employed in affections of the liver and spleen, and also in amenorrhœa.

For further details see Ibn-el-Beithar, III, 134-137.

**2. Capparis decidua** (Forsk.) Pax in Engl.-Prantl. Nat. Pflanzenf. III, 2, p. 231.

*Sodada decidua* Forsk. Fl. Aeg.-Arab. p. 81; Schweinf. Beitr. Fl. Aethiop., p. 74.

*Capparis aphylla* Roth Nov. Pl. sp. p. 238; DC. Prodr. I, 246; Oliv. Fl. trop. Afr. I.

*Capparis sodada* R. Br. in Denh. Trav. p. 255; Boiss. Fl. Or. II, 419.

*Arabic name* :—Sodâd.

*Description* :—A straggling, glabrous shrub, branches terete, smooth, green. Leaves on the young shoots only, the older branches being leafless, small, less than  $\frac{1}{2}$  inch long, linear-oblong, acute, spinous-pointed; petioles very short or 0; stipular thorns long, sharp, straight, orange-yellow.

Flowers in many-flowered corymbs, from the old branches, or from short lateral shoots; pedicels slender, about  $\frac{1}{2}$  inch long. Sepals: the outer pubescent, ciliate, subvalvate, the lower one very saccate, acuminate, the upper much smaller, ovate-oblong, concave; inner sepals elliptic, acute, with floccose margins. Petals red, narrow-oblong,  $\frac{2}{3}$  by  $\frac{1}{8}$  inch. Gynophore  $\frac{1}{2}$  inch long.

Fruit globular, size of a cherry, glabrous, beaked, red.

[According to Brandis the fruit is 2 inches long,  $\frac{1}{2}$ - $\frac{2}{3}$  inch in diameter, on a gynophore 1 inch long.]

*Locality* :—Precise place of occurrence not mentioned by Hildebrandt.

*Distribution* :—Upper Egypt, Nubia, Abyssinia, Darfur, Somaliland, Socotra, Central and Southern Arabia, Punjab, Sind, Deccan, Gujarat to Tuticorin.

*Note* :—I have included this species on the authority of Krause who has the following remark in his list: "As Hildebrandt rarely gives the exact locality and mostly omits it entirely it is quite possible that *C. decidua* (Forsk.) Pax which by no other botanist has been reported to occur on the two peninsulas of Aden and Little Aden, does not grow there at all, but may be found in the distant neighbourhood."

*Uses* :—The young flower-buds and fruits are eaten. In India the buds are pickled and the fruits eaten both when green and when fully ripe. The wood is employed in India for making combs, small beams

and rafters, for the knees of boots, etc. It is valuable because it is not attacked by white ants.

#### IV.—RESEDACEÆ.

Annual or perennial herbs, rarely shrubs. Leaves alternate, scattered or fasciculate, entire, 3-fid or pinnatifid; stipules minute.

Flowers racemose or spicate, bracteate. Calyx persistent, 4—7-partite, irregular; lobes imbricate in bud. Petals 2—7, hypogynous, entire or lobed, equal, or the upper larger. Disk conspicuous, sessile or shortly stipitate, often unilateral or absent. Stamens usually many, inserted upon the disk, free or connate, equal or unequal. Ovary 1-celled, of 2—6 connate carpels, closed or open at the apex or narrowed into short cuspidate styles; ovules on 2—6 parietal placentas, amphitropous or campylotropous.

Fruit a closed or open capsule, or indehiscent, (baccate in *Ochradenus*), or of as many minute follicles as carpels. Seeds many, reniform; albumen 0; embryo curved or folded; cotyledons incumbent.

*Genera* 6.

*Species* about 35.

*Distribution*:—S. Europe, N. and S. Africa, Asia Minor, Sind.

With petals . . . . . 1. *Reseda*.

Without petals . . . . . 2. *Ochradenus*.

##### 1. *Reseda* L.

Erect or decumbent glabrous or pilose herbs. Leaves entire, lobed or pinnatifid.

Flowers in terminal, bracteate racemes. Calyx 4—7-partite. Petals 4—7, unequal, multifid, the upper with a membranous appendage above the claw. Disk subsessile, broad, dilated on the upper side. Stamens 10—40, inserted within the disk. Ovary sessile or stalked, 3-lobed at the apex; placentas 3—6; ovules many.

Capsule indehiscent, open at the top. Seeds indefinite.

*Species* 26.

*Distribution*:—The countries bordering the Mediterranean and Western Asia.

**1. *Reseda amblyocarpa*** Fresen. Mus. Senckenb. I, 108; Walp. Repert. Bot. II, 753; A. Rich. Tent. Fl. Abyss. I, 13; Muell.-Arg. Monogr. Resed. p. 151 et in DC. Prodr. XVI, 530; Anders. Journ. Linn. Soc. V, Suppl. p. 6.



*Reseda lurida* Muell.-Arg. Monogr. Resed. p. 152, tab. 7, fig. 106.

*Reseda quartiniana* A. Rich. Tent. Fl. Abyss. I, 13.

*Description*.—A branching herb, subpruinose. Stem perennial, striate, angular. Leaves mostly entire, (the upper ones very rarely trifid), ovate-lanceolate, acute at both ends, attenuate into the petiole, 2-inches long, 3 lines— $\frac{1}{2}$  inch broad.

Flowers small, spicate; bracts long-subulate, deciduous; pedicels as long or longer than, the calyx. Sepals 6, unequal, linear, deciduous. Petals 5, the two larger ones 5—10-partite, the 3 smaller ones bipartite or entire.

Capsules obovate, obtusely tridentate, truncate. Seeds minute, reniform, black, punctate.

*Flowers and fruits* from March to December (Schweinf.).

*Locality*.—Ubique, on basaltic rocks, forming shrubs 3—4 $\frac{1}{2}$  feet high (Schweinf.); very common in all the valleys and on rubbish at the foot of the mountain, plain of Maala (Defl.); on the seashore (Edgew., Hook., Madden, Schomburgk, Harvey, Anders.); in the great valley between Steamer Point and town (Marchesetti); gravelly slope near the town (Busse); without locality (Birdw., Kuntze).

*Distribution*.—S. Arabia, highlands of Somaliland, Eritrea, Abyssinia.

*Note*.—It is doubtful whether *Reseda amblyocarpa* Fresen. constitutes a separate species, or whether it should be united with *Reseda pruinosa* Del. We do not think it is possible to decide the question by examining a few herbarium specimens. Oliver, Krause, and others have done the same with different results. Careful observations on the spot and examination of a greater number of plants are absolutely required. In order to draw the attention to some of the disputed points we consider it advisable to acquaint future visitors at Aden with the views expressed by some botanists.

Anderson writes in his *Florula*, p. 6: "After a careful examination of the species of *Reseda* in the Hookerian Herbarium, and the study of Mueller's elaborate monograph of the order, I can find no character, except the nature of the seeds, to separate this species from *R. pruinosa*, Del., or *R. Aucheri* and *R. bracteata*, Boiss., which seem to be merely varieties of *R. pruinosa*.

"Having made numerous dissections of all the species allied to *R. pruinosa*, Del., I am convinced that no specific character of the slightest value can be obtained from the number of the divisions or the shape of the petals. I consider *R. amblyocarpa*, Fresen., to be probably distinct from *R. pruinosa*, Del., and its varieties,—from its having a perennial stock, almost always entire leaves, a larger and denser spike, smaller flowers, and a slightly different capsule containing much smaller, black

and punctate seeds. *Reseda pruinosa* is evidently an annual, with generally trifid leaves; it has shorter spikes, larger flowers, and seeds nearly as large again as those of *R. amblyocarpa*, of a dark olive colour, and with an almost perfectly smooth testa. Both, however, are pruinose. The seeds of *R. pruinosa* are also sometimes slightly punctate, and *R. Aucheri*, Boiss., which ranks only as a variety of *R. pruinosa*, has often leaves as entire as those of *R. amblyocarpa*. In *Resedaceæ* the duration of the stock is probably an uncertain character, subject to the influence of climate, and especially the amount of moisture."

Oliver unites *R. amblyocarpa* with *R. pruinosa* (Fl. top. Afr. I, 103). "Notwithstanding Dr. Anderson's remarks," he says, "I do not think *R. amblyocarpa* can be maintained as specifically distinct from *R. pruinosa*. There is no difference as to the seeds between the Abyssinian and N. W. Indian forms, though in the Aden plant, which was specially under Dr. Anderson's notice, they are very small, black, and rough with minute points. The leaves of our only Abyssinian specimen are entire, though Fresenius describes them as mostly 3-fid. Most of the leaves are trifid in the ordinary state of *R. pruinosa*."

Cooke (in Fl. Bombay Presid. I, 49) describes the Sind specimens of *Reseda pruinosa* as having the lower leaves linear-lanceolate, the upper deeply 3—5-divided and the segments narrow-linear. The seeds are yellowish-white, smooth, subglobose.

Krause considers the differences pointed out by Anderson as sufficient to separate *R. amblyocarpa* from *R. pruinosa*.

It is evident from the above statements that the Aden specimen cannot be distinguished from *R. pruinosa* by anything like a constant morphological character, except by its black and punctate seeds. As to the colour of the seeds of *R. pruinosa* the authors do not agree. Anderson calls it dark olive, Krause olive-green, and Cooke yellowish-white.

## 2. *Ochradenus* Delile.

Branched glabrous herbs; branches slender, twiggy. Leaves small, linear, on the younger branches only, solitary or fascicled.

Flowers small, spicate or racemose, often polygamous. Calyx 5-fid. Corolla 0. Disk unilateral. Stamens 10—20, inserted within the disk. Ovary sessile, ovoid, closed at the top, 3-cuspidate, placentas 3; ovules many.

Fruit a many-seeded berry.

*Species* 2.

*Distribution* :—Spain, Syria, Egypt, Arabia, Sind.

1. *Ochradenus baccatus* Delile Fl.d'Egyp. (1812) p. 236, t. 31; Oliver Fl. trop. Afr. I, 104; Hook. Fl. Brit. Ind. I, 182. Cooke Fl. Bomb. Presid. I, 50.

*Description* :—Shrubby; branches terete, divaricate, striate, glabrous. Leaves  $\frac{1}{2}$ — $1\frac{1}{2}$  by  $\frac{1}{12}$  inch, entire, scattered near the base of the branches, olive-green, fleshy, narrow-linear, spathulate, with a callous tip, glabrous.

Flowers yellowish, minute, shortly pedicelled, laxly arranged in rigid racemes, 1—2-sexual. Calyx 5—6-lobed. Petals 0. Stamens 10—12.

Berry small,  $\frac{1}{5}$ -inch in diameter, shortly stalked, obovoid, attenuated at the base, the apex rounded and obtusely 3-denticulate. Seeds few, pale brown.

*Locality* :—Aden (Hildebrandt).

*Distribution* :—Syria, Egypt, Sind.

## V.—POLYGALACEÆ.

Herbs, shrubs or rarely arborescent, diffuse, erect or scandent. Leaves usually alternate, simple, entire, exstipulate.

Flowers racemose, capitate or paniced, bracteate. Sepals 5, free or 2 anterior connate, two inner larger, petaloid, wing-like, rarely subequal. Petals 3 or 5, declinate, free from each other, but usually united at the base with the staminal sheath, the lower one keeled and generally crested. Stamens 8, 5 or 6, monadelphous; anthers 1—2-celled, opening by a transverse valve or terminal pore. Ovary 2-celled or 1-celled by abortion or 3-celled; one ovule in each cell, pendulous.

Fruit generally a capsule, 2-celled, 2-seeded, loculicidal or indehiscent. Seeds often pilose or glabrous, almost always strophiolate and albuminous; embryo axile with flattened cotyledons and a short superior radicle.

*Genera* 15; *species* about 500.

*Distribution* : Throughout the warm regions of the world, except New Zealand.

### 1. *Polygala* L.

Herbs or shrubs. Leaves alternate or fascicled, rarely opposite or verticillate.

Flowers in terminal or lateral, axillary or extra-axillary racemes or heads, usually rather small. Sepals unequal, often persistent, the 2 inner larger, usually petaloid. Petals 3, united at the base with the staminal sheath, the lower one keeled and generally crested. Stamens 8; filaments united in their lower half into a split sheath;

anthers opening by pores. Ovary 2-celled; one ovule in each cell, pendulous.

Capsule 2-celled, loculicidal, 2-seeded. Seeds pilose or glabrous, almost always strophiolate and albuminous.

*Species* about 450.

*Distribution*:—Chiefly in the warmer regions of both hemispheres, except New Zealand and Tasmania.

Leaves  $\frac{1}{2}$ - $1\frac{1}{2}$  inches long—

Filaments of crest arranged in 2 bundles	.	.	.	1. <i>P. erioptera</i> .
Filaments of crest not arranged in 2 bundles	.	.	.	3. <i>P. chinensis</i> .
Leaves $\frac{1}{2}$ inch long	.	.	.	2. <i>P. Thurmanniana</i> .

**1. *Polygala erioptera* DC. Prodr. I, 326.**

*Polygala triflora* Anders. Journ. Linn. Soc. V, Suppl. p. 6; Oliv. Fl. trop. Afr., I, 128; non L.!

*Polygala oligantha* A. Rich. Tent. Fl. Abyss. I, 38.

*Polygala arabica* Edgew. Journ. As. Soc. Beng. XVI, 1213.

*Polygala irregularis* Defl. Bull. Soc. Bot. Fr. XXXII, 346.

*Arabic name*:—Bissere.

*Description*:—Annual, 6-15 inches high, usually branched from the base or nearly so; branches ascending, numerous, terete, pubescent or glabrescent. Leaves  $\frac{1}{2}$ - $1\frac{1}{2}$  by  $\frac{1}{12}$ - $\frac{1}{4}$  inch, very variable in form, from oblong-obovate to very narrow-linear, narrowed at the base, apex rounded or subacute, sometimes mucronate, clothed on both surfaces with minute simple hairs; petioles about  $\frac{1}{32}$  inch long.

Flowers yellow, in axillary or extra-axillary, very short few-flowered racemes; crest dorsal, of many bifid or linear filaments arranged in 2 bundles; pedicels slender, hairy,  $\frac{1}{8}$  inch long; bracts minute, ovate, hairy. Outer sepals  $\frac{1}{16}$  inch long, ovate, pubescent. Wings  $\frac{1}{8}$ - $\frac{3}{16}$  inch long, obliquely ovate-oblong, pubescent, a little longer than the capsule, with a strong green midrib and membranous, ciliate margins.

Capsules oblong-elliptic, not margined, pubescent, ciliate, shorter and narrower than the wings, obliquely emarginate. Seeds oblong, densely pilose; strophiole galeate, horny, smooth and shining or sometimes with a few hairs, obscurely 3-lobed.

*Flowers and fruits* in November and March (Schweinf.).

*Locality*:—Goldmore Valley, above the coal depôt of the Messag. Marit., Wadi Maala (Schweinf.); Koosaf Valley, ravine west of the Tower of Silence, plain of Maala (Defl.); without locality (Edgew., Hook., Madden, Anders., Birdw.).

*Distribution* :—Bengal, Punjab, Central and Southern Arabia, Upper Egypt, Nubia, Eritrea, Abyssinia, Kilimandjaro, Darfur, Kordofan, Senegambia, Cape Verd Islands.

*Note* :—Schweinfurth (in Bull. Herb. Boiss, 1899, Append. II, 297) makes of his Aden specimens the variety: *var. perennis*, with the following characteristics: "Parte inferiori lignescens foliis canescentibus oblongo-obovatis, oblongis vel linearibus obtusis, racemis ab initio paucifloris, demum cum rachide ecescente alis viridibus obovatis puberulis ciliatis 5-6 mm. longis. Semine 2.5 mm. longo, arillo 0.5 mm. non attingente."

## 2. *Polygala Thurmanniana* Chodat Monogr. Polygal. p. 346.

*Description* :—Perennial, woody; stem hard; branches erect, simple or few-branched, cinerascens; branchlets short. Leaves oblong or elliptic, canescent, obtuse, petiolate, about  $\frac{1}{3}$  inch long or shorter, about  $\frac{1}{8}$  inch broad, all subequal.

Racemes very short, numerous, superaxillary, few-flowered, often shorter than the leaves or scarcely longer. Bracts subequal, minute, subpersistent, much shorter than the pedicels. Pedicels pubescent. Sepals with membranous margins, pubescent or hirsute, subunequal. Wings elliptic, subunequilateral, with prominent nerves, ciliate on back and margin; slightly shorter than the corolla. Keel united at the base with the staminal sheath, galeate, appendiculate; crest showy, multifid with many linear filaments; upper petals for the greater part free, bearing a horn-shaped lobe on one side, not strongly ligular-obovate. Ovary, style, stigma and stamens as in *P. erioptera*.

Capsule elliptic, emarginate, or obovate-cuneate, with the margin long-ciliate, shorter and narrower than the wings. Seeds similar to those of *P. erioptera*.

This species differs from *P. erioptera* by its habit, the smaller and thicker leaves, and the shape of the upper petals.

*Locality* :—Gravelly slope of the Shum Shum Range (Ellenbeck, Hildebrandt). Endemic in Aden.

3. *Polygala chinensis* Linn. Sp. Pl. (1,753) p. 704; Hook. Fl. Brit. Ind. I, 204; Chodat Monogr. Polygal. part 2, 385, t. 29, fig. 45-46. Cooke Fl. Bomb. Pres. I, 60.

*Polygala arvensis* Willd. Sp. Pl. III, 876; Grah. Cat. Bomb. Pl. 11; Dalz. and Gibs. Bomb. Fl. 12.

*Polygala Rothiana* W. & A. Prodr. 37; Dalz. and Gibs. Bomb. Fl. 13.

*Polygala triflora* Linn. Sp. Pl., 705.



### 1. Polycarpæa Lam.

Erect or diffuse dichotomous herbs. Leaves usually linear or lanceolate, often fasciculate forming pseudo-verticels. Stipules scarious.

Flowers in diffuse or compact, panicled corymbose or solitary cymes. Sepals 5, scarious, or rarely herbaceous and scarious on the margins only. Petals 5, entire, 2-toothed or with the margins erose. Stamens 5, slightly perigynous or subhypogynous, or cohering with the petals, into a ring or tube. Ovary 1-celled; ovules many; style elongate, 3-grooved, 3-fid or 3-dentate.

Capsule 3-valved. Seeds obovoid or compressed; embryo curved, rarely almost straight.

*Species* about 24.

*Distribution*: In tropical or warm extratropical countries.

Sepals lanceolate, very acute. Leaves narrow-linear or linear-subulate . 1. *P. corymbosa*.

Sepals ovate-lanceolate. Leaves oblanceolate-spathulate, rosulate . 2. *P. spicata*.

Sepals ovate-elliptical, apiculate, centre thickly herbaceous. Leaves linear-lanceolate, revolute, mucronate . . . . . 3. *P. fragilis*.

### 1. *Polycarpæa corymbosa* Lam. Tab. Encyc. et Méthod. II, (1800) 129.

*Achyranthes corymbosa* L. spec. 296.

*Lahaya corymbosa* Schult. Syst. V, 404.

*Polycarpæa indica* Lam. Journ. Hist. Nat. II, 8.

*Polycarpæa eriantha* Hochst., Rich. Fl. Abyss. I, 303.

*Polycarpæa fallax* J. Gay, Mss. Herb. Kew.

*Polycarpæa humifusa* J. Gay *ibid*.

*Description*: An erect or decumbent annual herb, 2-3 inches to 1 foot high, often diffuse. Stems hoary-pubescent, repeatedly and often densely forked. Leaves narrow-linear or linear subulate with axillary tufts forming pseudo-verticels, pubescent or glabrous, much exceeding the lanceolate or subulate, scarious stipules,  $\frac{1}{2}$ -1 inch long or longer.

Flowers erect, in terminal dense or rather lax, silvery, many-flowered cymes; pedicels hoary-pubescent; bracts  $\frac{1}{2}$  inch long, silvery white, bristle-pointed. Sepals lanceolate, very acute, scarious, silvery-white or coloured, much exceeding the petals and capsule. Petals less than  $\frac{1}{2}$  the length of the sepals.

Capsules small, shining, brown.

*Locality*: Aden (Birdw.).

*Distribution*: Tropical Asia, Africa, America and Australia.

2. *Polycarpæa spicata* Wight, ex Arnott in Ann. Nat. Hist. III, 99; Webb. Fl. Aeth.-Aeg. p. 40; Boiss. Fl. Or., I, 738; Hook. f. Fl. Brit. Ind. I, 246.

*Polycarpæa staticæformis* Hochst. et Steud. ex Fenzl in Endl. Gen. Pl. p. 161.

*Description*: A small slender glabrous herb, 2-4 inches high, with straight spreading branches from the rosulate radical leaves. Leaves oblanceolate-spathulate, acute or obtuse. Stipules lanceolate, very acute; prolonged to a fine point.

Flowers in fascicled spikes at the apex of the peduncles; bracts scarious. Sepals scarious, lanceolate, acute, with a coloured, broad, herbaceous midrib. Petals very small, oblong.

Capsule about  $\frac{1}{2}$  as long as the sepals.

*Fruits*: January 1880 (Balfour).

*Locality*: Crater of the Shum Shum at the height of 1500 feet near the flagstaff (Defl.); on the Shum Shum Range (Busse); without locality (Birdw., Beevor, Balfour).

*Distribution*: Gujarat, Sind, Central and Southern Arabia, Socotra, Abyssinia, Nubia, Upper Egypt.

3. *Polycarpæa fragilis* Del. Fl. d'Eg. p. 24, tab. 24, fig. 1; Dene. Ann. Sc. Nat. (1835) p. 262, DC. Prodr. III, 374, Batt. et Trab. Fl. d'Alg. II, 164; Boiss. Fl. Or. I, 737; Oliver Fl. trop. Afr. I, 146.

*Description*:—Hoary-puberulous or tomentose herb of  $\frac{1}{4}$ —1 foot with numerous spreading branches usually from a woody nodose stock; lateral branches usually short. Leaves linear-lanceolate with revolute margins, conspicuously mucronate, hoary or tomentose. Stipules silvery, membranous.

Flowers in small, rather densely fascicled cymes either terminal or lateral on the very short lateral branchlets. Sepals ovate-elliptical, apiculate, rather thick and herbaceous with a broadly membranous margin, exceeding the petals.

*Locality*:—Goldmore Valley (Schweinf., Defl.); great valley between Steamer Point and town (Marchesetti); without locality (Beevor).

*Distribution*:—Central and S. Arabia, Nubia, Egypt, Tripolis, Algeria.

## 2. *Sphaerocoma* T. Anders.

A small shrub. 1-2 feet high, much-branched, glabrous, glaucous. Stem erect, woody. Leaves on the nodes opposite, cauline leaves fascicled, fleshy, terete, obtuse at the apex, alternate at the base, 6-10 lines long.



Glomerules pedunculate, globose, ebracteate, fuscous, 1-3 lines long; peduncles erect, 1—1½ lines long, with 1—2 sepaloïd bracts. Flowers densely aggregate, densely setigerous from the accrescent sepals of the abortive flowers. Sepals ovate, concave, (those of the sterile flowers linear), setaceous in fruit; setæ entire. Petals 5, entire, shorter than the sepals. Stamens 5, inserted on a small annular disk. Ovary 1-celled, 2-ovuled; style bifid.

Utricle indehiscent, small, subchartaceous, 1-seeded.

*Species*: 1.

*Distribution*: Arabia and Nubia.

**1. Sphaerocoma Hookeri** Anders. Journ. Linn. Soc. V, Suppl. p. 7, tab. 3.

Psyllothamnus Beeveri Oliv. in Hook. Ic. Pl. ser. III, V, 77, tab. 1499.

Characters of the genus.

*Flowers*:—December 1888 (Schweinf.), December 1847 (Hooker), February 1851 (Thomson), April 1890 (Defl.).

*Fruits*:—March 1878 (Perry).

*Locality*:—Goldmore Valley, northern slope of the Shum Shum Range above Maala at a height of 830 feet (Defl.); northern side of the Shum Shum Range (Schweinf.); on the Shum Shum Range (Busse); without locality (Hooker, Thomson, Perry, Birdw.).

*Distribution*: Soturba, Aden.

### 3. Gypsophila L.

Perennial or annual, often glaucous herbs, rarely shrubby. Leaves usually flat, very rarely subulate.

Flowers in paniced cymes, rarely solitary in the forks. Calyx turbinate, tubular or campanulate, 5-toothed or lobed, with 5 broad green nerves and membranous interspaces. Petals 5, claw narrow; limb entire or notched, without (rarely with) a scale. Disk small. Ovary 1-celled; styles 2 (rarely 3); ovules many.

Capsule 4-valved to or below the middle, few or many-seeded. Seeds subreniform, hilum lateral; embryo lateral.

*Species* about 50.

*Distribution*: Europe and W. Asia, Somaliland.

**1. Gypsophila montana** Balf. f. in Proc. Roy. Soc. Edinb. Vol. 11, (1882), 501.

*Gypsophila somalensis* Franch. Sert. Somal. in Miss. Révoil 14.

*Description*:—A perennial herb; stem woody, procumbent, much-branched; branches ascendent, up to 2 feet long, glabrous, but often

glandular-pilose. Leaves  $1\frac{1}{2}$  inches long,  $\frac{1}{3}$ — $\frac{1}{2}$  inch broad, obovate-spathulate or oblong and gradually attenuate into a short petiole, obtuse and often mucronulate, or acute and glabrous, or subglandular pilose.

Cymes dichotomous, much-branched, divaricate; pedicels glandular-pilose, the ultimate ones capillary, erect,  $\frac{1}{2}$  inch long; bracts foliaceous, much shorter than the pedicels. Calyx subglabrous or with scattered glandular-pilose hairs,  $\frac{1}{8}$  inch long, campanulate, 5-lobed, lobes long acute, as long as the tube, with submembranous margin. Petals three-nerved, glabrous, white or lilac,  $\frac{1}{4}$  inch long; claw gradually broadened into a truncate erose or emarginate limb, acute at the base. Ovary 8-ovulate.

Capsule subbifid at the apex, shortly stipitate, as long as the calyx, few-seeded. Seeds black, tuberculate; radicle elongate.

*Flowers*:—End of November and March (Schweinf.).

*Fruits*:—March (Schweinf.).

*Locality*:—Above the coal depôt of the Messag. Marit., very common in the plain of Maala, on dry rocky ground and on gravel of water-courses together with *Cassia adenensis* Benth., etc. (Schweinf.) ; plain of Maala (Defl.) ; at the foot of the Shum Shum Range (Hildebrandt) ; without locality (Birdw.).

*Distribution*:—Yemen, Socotra, Somaliland.

*Note*:—Balfour describes a glabrous form from Aden under the varietal name:

**Var. diffusa** Balf. f. Bot. Socotra, p. 20.

“Herba inflorescentia diffusa ramosa ramulis ultimis capillaribus floribusque minoribus.”

“The Socotran plant [*Gypsophila montana* Balf. fil.] appears to be identical with a hitherto undescribed one first found at Aden by Thomson in 1872, and since sent home from that locality by several collectors. We obtained it there in abundance. In the Aden plant variations in habit and clothing of the same character as in the Socotran specimens are observed, though not so strongly marked. But there is a further variation observable in the inflorescences and flowers of the glabrous form as found at Aden. The former become exceedingly diffuse, and the pedicels are very short and delicate; the latter are greatly reduced in size, often less than half those of the Socotran plants. In fact the inflorescence assumes more the appearance of an *Arenaria*. I can find, however, no sufficient character separating the forms as species, though a varietal name may be assigned to the Aden plant.” Botany of Socotra, p. 20.

This variety seems to be endemic in Aden.

## VII. PORTULACACEÆ.

Herbs or shrubs, usually more or less succulent and glabrous. Leaves alternate or opposite, entire, often succulent, with scarious or setose stipular appendages.

Flowers solitary or capitate and terminal, racemose or cymosely paniced, occasionally axillary. Sepals usually 2, free or adnate to the ovary at the base, much imbricate. Petals 4-5, sometimes more, hypogynous or perigynous, free or connate at the base. Stamens 4 to many, inserted with the petals and often adnate to them at the base; filaments filiform; anthers 2-celled; cells parallel, dehiscing longitudinally. Ovary free or semi-inferior, 1-celled; ovules 2 to many on basal funicles or a central column, amphitropous; style 2-8-fid, branches longitudinally stigmatose.

Capsule membranous or crustaceous, circumsciss or dehiscing by as many valves as there are styles. Seeds 1 or many, compressed; embryo curved round mealy albumen.

*Genera* 15; *species* about 120.

*Distribution*:—Old World, but chiefly America.

### 1. *Portulaca* L.

Fleshy spreading or erect herbs. Leaves alternate, subopposite or opposite, often whorled around the flowers with squamiform or setose stipular appendages, plane or terete.

Flowers terminal, solitary or fascicled, sessile or pedicellate. Sepals 2, united at the base into a tube adnate to the ovary, the free part above deciduous. Petals 4-6, inserted on the top of the tube of the calyx just where it becomes free from the ovary. Stamens 8 or numerous, inserted at the base of the petals. Ovary half-inferior, multi-ovulate. Style 2-3-8-fid.

Capsule membranous or rather crustaceous, half-inferior, with circumscissile dehiscence. Seeds numerous, compressed, reniform. Embryo peripheric.

*Species* about 16.

*Distribution*:—Australia, Africa, chiefly Tropical America.

#### 1. *Portulaca quadrifida* L. DC. Prodr. III, 354.

*Portulaca anceps* Rich. Fl. Abyss. I, 301.

*Portulaca linifolia* Forsk. descr. p. 92.

*Illecebrum verticillatum* Burm. Fl. Ind. p. 66.

*Description* :—A prostrate and rooting or decumbent annual, woolly at the joints. Leaves plane, fleshy,  $\frac{1}{8}$ - $\frac{1}{4}$  inch long, ovate, acute, with long and numerous stipular setæ.

Flowers terminal, solitary, subsessile, surrounded by silvery hairs and an involucre of 4 leaves. Sepals broadly oblong, rounded at the apex. Petals 4, yellow, oblong-obovate. Stamens 8. Style slender, 4-fid to near the middle.

Capsules conical. Seeds minutely tubercled.

*Flowers* :—August 1898 (Birdwood).

*Locality* :—Aden (Birdwood, Hunter).

*Distribution* :—Upper and Lower Guinea, Abyssinia, India.

*Note* :—“In 1877, during the months of February and March, many parts of the settlement were covered with a green mantle of *Portulaca*. Rain fell in frequent showers during those months.” (Hunter.)

### VIII.—MALVACEÆ.

Herbs or soft-wooded shrubs and trees, their surface often covered with soft stellate pubescence; wood light. Leaves alternate, mostly stipulate, usually palminerved, entire or more or less deeply lobed.

Flowers large, regular, hermaphrodite or very rarely diœcious or polygamous, axillary, terminal, solitary, clustered or cymose-paniculate. Involucral bracts 2 or more or none. Sepals generally 5, more or less connate, valvate in bud. Petals 5, hypogynous, more or less adnate to the staminal tube, in bud twisted or imbricate. Stamens  $\infty$ , rarely definite, usually connate into a tube; anthers globose, oblong or reniform, cells sinuous or twisted, linear or annular, ultimately one-celled, bursting lengthwise. Ovary 2-many-celled, entire or lobed, of 2-5 or more carpels, whorled round a central axis. Styles distinct or more or less connate; stigmas linear, peltate, capitate or spatulate.

Fruit of dry cocci, or capsular and loculicidal. Seeds reniform or obovoid, rarely arillate. Embryo curved in reniform seeds, usually straight in obovoid; cotyledons leafy, usually folded crumpled.

*Genera* 57; *species* about 700.

*Distribution* :—Throughout the world except in the Arctic regions.

Bractlets none . . . . . 1. Abutilon.

Bractlets present.

Style ultimately dividing into stigmatic branches . . . 2. Hibiscus.

Style club-shaped at the apex (cultivated) . . . 3. Thespesia.

#### 1. Abutilon Tournef.

Herbs or shrubs covered with down. Leaves cordate, ovate, angled or lobed.

Flowers axillary or terminal. No involucre bracts. Calyx 5-cleft. Staminal tube divided at the apex into numerous filaments. Ovary 5- $\infty$ -celled, each cell with 1-3 or rarely more ovules. Styles as many as the cells of the ovary; stigmas capitate.

Ripe carpels separating from the short central axis, rounded on the back, dehiscent, truncate, pointed, apiculate or with a short oblique or horizontal mucro. Seeds reniform, ascending or horizontal, dark brown.

*Species* about 170.

*Distribution*:—In nearly all warm regions.

**1. *Abutilon fruticosum*** (Fresen.) Guill. et Perr. Fl. Seneg. I, 73; Franch. Sert. Somal. in Miss. Révoil p. 15; Boiss. Fl. Or. I, 836; Hook f. Fl. Brit. Ind. I, 328; Oliv. Fl. trop. Afr. I, 187.

*Abutilon denticulatum* Planch. in Herb. Hook.; Anders. Journ. Linn. Soc. V, Suppl. p. 8.

*Abutilon microphyllum* A. Rich. Tent. Fl. Abyss. I, 70.

*Sida kotschy* Hochst. mss.

*Sida gracilis* R. Br. in Salt's Abyss. App. 65.

*Sida denticulata* Fresen. in Mus. Senckenb. I, 182.

*Description*:—A much branched rigid perennial or undershrub, densely covered with fine white down. Leaves  $\frac{1}{2}$ -2 inches long, on short stalks, cordate-ovate, acute, denticulate, covered with soft down on both surfaces; stipules linear.

Peduncles solitary, axillary, longer than the petiole, 1-3 flowered, jointed. Sepals half the length of the corolla, ovate, acute. Corolla yellow. Carpels 10, persistent, each one oblong, truncate, without beak, splitting down the back.

Fruit  $\frac{1}{2}$  inch long, cylindrical, truncate. Seeds 2-3 in each carpel, small, brown, dotted with minute white hooked hairs.

*Flowers*:—March 1878 (Perry).

*Locality*:—Goldmore Valley (Defl.); on the Shum Shum Range (Schweinf.); without locality (Hook., Birdw., Perry).

*Distribution*:—Canaries, Trop. Africa, Palestine, Arabia, India, Ceylon.

## 2. *Hibiscus* L.

Herbs, shrubs or small trees, generally more or less downy or hairy. Leaves various, usually palmately divided. Stipules usually small and deciduous. Involucre bracts 4-12, rarely 0.

Sepals 5, valvate. Staminal tube bearing on the outside short filaments along its entire length, and sometimes also at the apex, summit truncate or 5-toothed, anthers reniform. Ovary 5-celled, the cells

alternating with the petals; ovules 3 or more in each cell. Styles 5, spreading, connate below; stigma capitate or spatulate.

Capsule loculicidally 5-valved, sometimes 10-celled through false dissepiments. Seeds numerous, reniform, subglobose, rarely obovoid, glabrous, tomentose or woolly.

*Species* about 150.

*Distribution* :—Chiefly in the tropical region of both hemispheres.

Involucral bracts 6, pedicel jointed above the middle, flowers

pink or white . . . . . 1. *H. micranthus*.

Involucral bracts 8—10, pedicel jointed near the apex,

flowers yellow . . . . . 2. *H. Welshii*.

1. *Hibiscus micranthus* L. Mant. p. 308; DC. Prodr. I, 453; Anders. Journ. Linn. Soc. V, Suppl. p. 8; Hook. Fl. Brit. Ind. I, 335; Oliv. Fl. trop. Afr. I, 205.

*Hibiscus rigidus* L. f. Suppl. p. 310.

*Hibiscus clandestinus* Cav. Ic. I, 1, t. 2.

*Hibiscus ovalifolius* Vahl Symb. I, 50.

*Hibiscus intermedius* Hochst. in Schimp. Pl. Abyss. n. 2211.

*Hibiscus parvifolius* Hochst. *ibid*.

*Hibiscus versicolor* Schum. et Thonn. Pl. Guin. p. 311.

*Urena ovalifolia* Forsk. Fl. Aeg.-Arab. p. 124.

*Arabic name* :—Osaru.

*Description* :—An undershrub, with long, rod-like, spreading branches, thinly covered with appressed, stellate, bristle-like hairs. Leaves 1-2 inches long, more or less scabrid and hairy, ovate, acute or obtuse, serrate, sometimes cordate; stipules  $\frac{1}{2}$  inch long, subulate, hairy.

Pedicels longer than the petioles, reaching  $1\frac{1}{4}$  inches, slender, jointed above the middle. Involucral bracts 6, filiform, hairy, longer or shorter than the calyx. Calyx short, deeply divided; lobes lanceolate, hairy. Corolla small, pink or pink and white, stellately hairy outside. Stamens in tufts on the staminal tube.

Capsules  $\frac{1}{4}$ – $\frac{5}{16}$  inch in diameter, globose. Seeds reniform, cottony.

*Flowers* :—March and April (Defl.); March (Perry).

*Locality* :—Near the old cemetery (Anders.); near Maala (Schweinf.); on the top of the Shum Shum Range (Busse); near the flagstaff on the Shum Shum Range (Defl.); without locality (Birdw., Perry).

*Distribution* :—Tropical Africa, S. Arabia, India, Ceylon.

*Note* :—Deflers says that the flowers are purplish when they open in the morning and become white in the afternoon.

**2. Hibiscus Welshii** Anders. Journ. Linn. Soc. V, Suppl. p. 8 ; Defl. Bull. Soc. Bot. France XXXII, 347.

*Cienfugosia Welshii* Gürke Herb. Berol. (ex Krause).

*Description* :—Shrubby, glandular-punctate; branches rod-like. Leaves petiolate, orbicular, subreniform, palmately 5-lobed, dentate-serrate, glandular-punctate on both sides, nerves and petioles slightly hairy with spreading bristles, later on glabrescent.

Pedicels axillary, solitary, one-flowered, by almost  $\frac{1}{2}$  longer than the petioles, jointed near the apex, clavately thickened. Involucral bracts 8-10, subulate, small, sparingly hairy, ciliate on the margin. Calyx marcescent, 5-dentate, campanulate, 15-ribbed, punctate with 2 lines of dark glands along the ribs. Petals yellow, glandular hairy, red-spotted at the base, obovate, early deciduous, 2-3-times as long as the calyx. Carpels lanceolate, hairy, glandular-reticulate outside.

Seeds densely tomentose with yellow bristles.

*Flowers* in March and April.

*Locality* :—Maala, near the telegraph office, Goldmore Valley (Schweinf.) ; ravine near Steamer Point, Goldmore Valley (Defl.) ; without locality (Hook., Anders., Birdw., Hildebrandt).

This plant is endemic in Aden.

*Note* :—The figure given by Anderson in his 'Florula' is very accurate but for the pedicels which are usually longer and jointed nearer to the apex.

### 3. *Thespesia Soland.*

Trees or erect shrubs. Leaves entire, or angularly lobed.

Inflorescence axillary, solitary or racemose. Involucral bracts 5, deciduous, or 0. Calyx truncate, 5-toothed. Staminal tube toothed at the apex. Ovary 4-5-celled; cells few-ovuled, styles club-shaped at the apex, 5-furrowed, or subdivided into erect club-shaped short stigmatiferous branches.

Capsule loculicidally dehiscent or almost indehiscent. Seeds glabrous or pubescent. Cotyledons much folded, usually glandular with black dots.

*Species* about 6.

*Distribution* :—Tropical Asia, Africa and the Pacific Islands.

The following species is cultivated in Aden in the vicinity of the tanks :—

**1. Thespesia populnea** Correa. The Tulip or Portia tree.

A middle-sized evergreen tree of rapid growth, heartwood small, dark-coloured. Leaves cordate, acuminate, entire, on both sides with minute peltate scales, blade 3-5, petiole 1-4 inches long.

Flowers axillary, solitary or 2 together. Bracteoles none, or early deciduous. Calyx cup-shaped, truncate. Corolla yellow, passing into purplish pink when withering, 2 inches in diameter. Staminal tube 5-toothed at the apex.

Capsule dehiscient or indehiscent. Seeds silky.

This plant is found throughout the tropics on the beach and in tidal forests. In the western part of India it is largely planted as an avenue tree. It usually flowers throughout the year.

### IX.—STERCULIACEÆ.

Herbs, shrubs or trees, the tomentum of hairs stellate, rarely mixed with simple hairs. Leaves alternate or exceptionally opposite, simple and pinnately or palmately nerved, entire, toothed or lobed or digitately compound. Stipules sometimes absent.

Flowers regular, hermaphrodite or unisexual. Sepals valvate, more or less combined into a calyx. Petals 5, hypogynous, free or adhering to the staminal column, contorted-imbricate in the bud or small and scale-like or none. Stamens usually united into a ring, a cup or a tube with 5 terminal teeth or lobes (staminodes) alternating with or opposite to the petals, and one or more anthers sessile or stipitate (on distinct filaments) in each interval, the anthers 2-celled and opening outwards by longitudinal slits, or exceptionally the anthers are numerous and the staminodes are wanting, or the stamens are 5, free and alternate with the sepals or the anther-cells confluent or opening by terminal pores. Ovary free, 2-5-rarely 10-12-celled or reduced to a single carpel. Styles entire or divided into as many branches as there are cells or rarely styles free.

Fruit various; seeds sometimes hairy, sometimes arillate; testa coriaceous, fibrous or membranous, tegmen horny; albumen fleshy, farinaceous or horny, entire or bipartite or none. Cotyledons flat or folded, thin or fleshy. Radicle short, near to or sometimes remote from the hilum.

*Genera* 41; *species* about 500.

*Distribution*:—Tropical regions, South Africa, Australia.

Petals absent	.	.	.	.	.	.	.	1. Sterculia.
Petals present	.	.	.	.	.	.	.	2. Melhania.

#### 1. Sterculia L.

Trees with entire or lobed leaves.



Flowers in axillary or terminal panicles, unisexual or polygamous. Calyx 4-5-fid or partite, usually coloured. Petals absent. Staminal column bearing 10-30 anthers arranged in a ring or without order. Carpels of the ovary 5, subdistinct; each cell with 2- $\infty$  ovules. Styles consolidated; stigmas 5-lobed.

Ripe carpels distinct, follicular, sessile or stalked, woody or membranous. Seeds 1 to many, naked or rarely winged, sometimes arillate. Albumen splitting into 2 segments, adherent to the cotyledons; cotyledons flat or slightly undulate, thin or fleshy. Radicle directed towards the hilum or away from it.

*Species*:—100-120.

*Distribution*:—Warmer regions of both hemispheres, especially in tropical Asia, one section (*Brachychiton*) in Australia.

**1. *Sterculia arabica* (R. Br.) T. Anders. Journ. Linn. Soc. V, Suppl. p. 9, t. 2, B.**

*Sterculia abyssinica* R. Br. (*partim*) in Append. Salt. Abyss. et in Pl. Jav. Rar. 227.

*Description*:—A large tree, the stem reaching at Aden about 5 feet in circumference and 13-16 feet in height, with thick, greyish, rugose branches. Petioles 1-5 inches long, as long as the leaves, subglabrous, terete. Leaves rotundate, broadly ovate-obtuse, or subrhomboid acute, sometimes subcordate at the base, entire or crenate, glabrous on both sides; stipules subulate, deciduous.

Racemes at the end of the branches or axillary, simple, few-flowered, much shorter than the leaves ( $\frac{1}{2}$ -1 inch), slender; peduncles glabrous; pedicels jointed, slightly pilose at the apex; bracts minute, subulate. Flowers small, yellowish-green, lurid-purple at the base. Calyx divided about halfway down into 5 ovate-lanceolate spreading segments, pilose on both sides; in male flowers the staminal tube exserted, 10-lobed, glabrous.

Follicles 4 (Anderson), 4-6 (Defflers), 2-5 (Balfour), terete, narrowly ovate, acute, subrostrate, fulvo-pubescent,  $\frac{3}{4}$  inch long,  $\frac{1}{2}$  inch broad.

*Flowers*:—Dec. 1889 (Deffl.), January 1880 (Balfour), February 1851 (Thomson), April 1861 (Thomson).

*Fruits*:—Nov. (Schweinf.).

*Locality*:—Goldmore Valley, Wadi Maala (Schweinf.); ravine north of Shum Shum Range (Busse); slope of Shum Shum Range, crater south-west of the Tower of Silence (Deffl.); without locality (Hook., Hildebr., Birdw.).

*Distribution* :—Hadramaut, Yemen, Socotra.

*Note* :—The confusion which existed 50 years ago between *Sterculia arabica*, Anders., *S. abyssinica*, R. Br. and *S. triphaca*, R. Br. can still be found in some more recent publications. It may, therefore, not be considered superfluous, if we reproduce in this place a short passage from Anderson's *Florula*, in which he tried to clear up the doubtful points. He says :—

“I have examined on two distinct occasions the original specimens of *S. abyssinica*, R. Br., in Salt's Abyssinian plants in the British Museum, and at the same time compared them with ten or twelve specimens of the Aden species of *S. arabica*. I find that among Salt's specimens of *S. abyssinica* there is a fragment of *S. arabica*, consisting of a portion of a branch with three leaves, and a fruit of four follicles on a very short axillary peduncle; and from this the description in the '*Plantæ Javanicæ Rariores*,' of the fruit and partly of the leaves, of *S. abyssinica* was deduced. Though Salt's specimens of these two species of *Sterculia* are said to be from Abyssinia, they are possibly from quite distinct localities; for that traveller, after touching at several points on the east coast of Africa, visited Aden and Arabia Felix. Whenever a favourable opportunity occurred he seems to have collected plants, but (judging from his herbarium in the British Museum) without appending any notes or records of stations to his specimens. It is probable that the specimens of *S. abyssinica* were obtained at Mozambique where Salt spent several days; and the fragment of *S. arabica* mixed with the former species is most likely from Aden.

“Had R. Brown seen flowering specimens of *S. arabica*, he would doubtless at once have distinguished the two species, and moreover, would have united his *S. abyssinica* with his other species of *S. triphaca*, described from an imperfect specimen in fruit in the Paris Herbarium, collected by Loureiro at Mozambique, and which seems to have been considered distinct by Brown, on account of the fruit differing from what he mistook for the fruit of *S. abyssinica*, but which I have above shown to be the fruit of *S. arabica*.....

“*S. arabica* is easily distinguished from *S. abyssinica* by its short-petioled, round, rarely acute, and perfectly glabrous leaves, very short, axillary, simple, nearly glabrous racemes, and by the markedly different fruit, which is only half the size of that of *S. abyssinica*.

“The leaves, petioles, and peduncles of *S. abyssinica*, besides possessing other and more important characters, are always more or less tomentose.” (Anderson, *Flor. Aden*, pp. 9 and 10.)

Cf. etiam Balfour, *Bot. Socotra*, p. 35.

## 2. *Melhanian* Forst.

Herbs and undershrubs covered more or less densely with stellate tomentum. Leaves ovate or roundish.

Peduncles simple or cymose, remote or crowded at the ends of the branches. Bractlets broad or narrow. Sepals 5. Petals 5, convolute, marcescent. Fertile stamens 5, alternating with an equal number of staminodes, all combined below into a shallow cup. Anthers extrorse, cells parallel; connective thick. Ovary sessile, 5-celled; cells with 1 or many ovules. Styles short, dividing above into 5 liguliform stigmatic branches.

Capsule loculicidally dehiscent. Seeds albuminous. Cotyledons plicate, 2-partite; radicle inferior.

*Species* 16.

*Distribution*:—Warmer parts of Africa, Asia, Australia.

1. *Melhanian Denhamii* R. Br. in Denh. et Clapp. Voy. App. p. 233. *Brothera bracteosa* Guill. et Perr. Fl. Seneg. I, 80, tab. 17.

*Melhanian Kotschy* Hochst. Pl. Nub. sect. I, no. 219.

*Melhanian bracteosa* Boiss. Fl. Or. I, 841.

*Cardiostegia Kotschy* Presl. Epimel. Bot., p. 249.

*Description*:—A small shrub; stock woody, dividing into a large number of crowded, spreading, downy, somewhat compressed branches. Leaves  $\frac{3}{4}$ -1  $\frac{1}{2}$  by  $\frac{1}{4}$ - $\frac{3}{4}$  inch, elliptic, stellately hairy above, hoary pubescent beneath, crenate-serrate, apiculate, 5-nerved at the base; petioles  $\frac{1}{2}$ - $\frac{3}{4}$  inch long; stipules subulate, hairy.

Flowers in axillary peduncled racemose cymes; pedicels very short; involucre bracts greatly enlarged, up to  $\frac{2}{3}$  inch broad in fruit, reniform, broader than long, membranous, veined, apiculate, enclosing the capsule. Sepals ovate-lanceolate, pubescent. Corolla yellow. Style as long as the ovary.

Capsules globose, pubescent, 5-celled with 1 or 2 smooth seeds in each cell.

*Fruits*:—Nov. 1884 (Beever).

*Locality*:—Crater of the Shum Shum Range, near the Flagstaff (Defl.); without locality (Birdw., Beever); seems to be very rare.

*Distribution*:—Nubia, Eritrea, Kordofan, Darfur, Central and S. Arabia, Baluchistan, Sind.

## X.—TILIACEÆ.

Trees or shrubs, sometimes herbaceous plants. Leaves alternate, entire, dentate or rarely lobed. Stipules in pairs, deciduous, rarely persistent or 0. Flowers cymose, lateral and terminal, rarely axillary

but often by the side of the leaf. Sepals 3-5, free or connate or united into a campanulate calyx, usually valvate. Petals as many or fewer or 0, inserted round the base of the torus, contorted or variously imbricate, induplicate or valvate. Stamens usually indefinite, inserted on a short contracted torus or on an elongated one. Filaments free or more or less united below, sometimes 4-5-adelphous, all fertile or some sterile. Anthers 2-celled, linear or glabrous, dehiscing longitudinally or by pores. Ovary free, 2-10-celled. Style entire; stigmas usually small, as many as the cells of the ovary, sometimes large; ovules anatropal, sometimes solitary, pendulous, generally numerous, in two rows in each cell.

Fruit 2-10-celled or 1-celled by abortion, dry or fleshy, loculicidally dehiscent, indehiscent or separating into cocci. Seeds solitary or few, ascending, pendulous or transverse; testa coriaceous, sometimes pilose. Albumen fleshy. Embryo straight. Cotyledons roundish, leafy. Radicle next to the hilum.

*Genera* 40. .

*Species* about 350.

*Distribution* :—Especially abundant in the tropics, less in the temperate zones.

Petals glandular at the base internally	.	.	.	1. <i>Grewia</i> .
Petals not glandular	.	.	.	2. <i>Corchorus</i> .

### 1. *Grewia* L.

Trees or shrubs, mostly deciduous, at times scrambling or climbing. Branchlets, leaves and sepals mostly clothed with stellate hairs. Simple hairs on petals, androgynophore and ovary. Leaves more or less distinctly dentate, rarely lobed, base generally oblique, with 3, rarely 4 or 5 basal nerves.

Flowers usually yellow, in axillary, terminal or extra-axillary cymes or panicles. Sepals 5, distinct, valvate, often coloured on the inside, deciduous. Petals 5, shorter than the sepals, in most species with a thick base (claw), bearing on the inside an area, generally papillose, surrounded by a densely villous, semicircular or circular rim. Stamens as a rule  $\infty$ , free, together with the ovary on a raised more or less costate torus (androgynophore or gonophore), the ridges of which alternate with the petals, the lower part glabrous, the upper hairy or tomentose. Ovary 2- or 4-celled, in most species tomentose; style 1, subulate; ovules as a rule 8; stigma generally broad, more or less distinctly 2-5-lobed or lacinate.

Fruit a drupe, often deeply lobed, with 1—4 pyrenes, which are 1- or few-seeded, the endocarp often osseous, surrounded by a fibrous mesocarp.

Seeds ascending or horizontal; albumen copious, fleshy or rarely scanty, or almost 0; cotyledons flat, foliaceous or fleshy.

*Species* :—Over 100.

*Distribution* :—Tropical and sub-tropical, from Africa to Queensland.

**1. *Grewia populifolia*** (Fors.) Vahl Symb. I, 33; DC. Prodr. I, 511; Anders. Journ Linn. Soc. V, Suppl. p. 10; Boiss. Fl. Or. I, 843; Hook. Fl. Brit. Ind. I, 385; Oliv. Fl. trop. Afr. I, 246.

*Chadara tenax* Forsk. Fl. Aeg.-Arab. p. CXIV.

*Grewia betulæfolia* Juss. in Ann. Mus. IV, 92, pl. 4, f. 1.

*Grewia reticulata* Hochst. Pl. Schimp. Abyss.

*Grewia ribesiæfolia* Hochst. Pl. Schimp. Abyss.

*Grewia crenata* Hochst l. c.

*Grewia membranacea* Rich. Fl. Abyss, I, 90.

*Description* :—A shrub or undershrub, 2—6 feet high, with stiff divaricate branches; bark white; wood yellowish-white, tough. Branchlets and leaves slightly rough with short stellate hairs. Leaves up to  $1\frac{1}{2}$  by  $1\frac{1}{4}$  inches, broadly ovate or suborbicular, sometimes obovate, acute or obtuse, coarsely dentate, glabrous or nearly so, base rounded or cuneate; petioles  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, slender; stipules small, linear, caducous.

Flowers white,  $\frac{3}{4}$ —1 inch across; peduncles usually solitary, leaf-opposed, thickened near the top, bearing usually 1 flower; bracts 2, near the middle of the pedicel, caducous, leaving a mark which has the appearance of a joint. Sepals  $\frac{3}{4}$  inch, linear-oblong, tomentose outside, blade attached to back of claw. Petals linear-oblong, usually notched. Torus with 5 densely villous teeth at the top beneath the ovary. Ovary 4-lobed, glabrous as a rule; style longer than the stamens; stigma 4—5-lobed.

Drupes smooth, orange-yellow, about  $\frac{1}{2}$  inch broad, usually of 2 separable halves, each half didymous; stones 1—4, muricate, 1—2-celled.

*Fruits* : June 1878 (Perry), Aug. 1880 (Hunter).

*Locality* :—Above the European cemetery of Steamer Point (Schweinf.); ravine west of the Tower of Silence, crater of the Shum Shum Range (Defl.); without locality (Hook., Birdw., Perry); neighbourhood of Aden (Hunter).

*Distribution* :—Tropical Africa, Senegambia, Mauritius, Egypt, Arabia, Persia, Sind, W. India, Ceylon.

2. *Corchorus* Linn.

Herbs or undershrubs, more or less covered with stellate tomentum. Leaves serrate.

Flowers small, yellow; peduncles very short, axillary or leaf-opposed, 1- or few-flowered, bracteate. Sepals 4—5. Corolla of 4—5 glandless petals. Stamens indefinite or rarely twice as many as the sepals, inserted on a short torus. Ovary 2—5-celled; ovules many in each cell; style short, the apex stigmatose, hollow, crenulate.

Capsule elongated, slender or subglobose, smooth or prickly, loculicidally 2—5-valved, internally sometimes transversely septate. Seeds numerous, pendulous or horizontal, albuminous. Embryo generally curved; cotyledons foliaceous.

*Species*:—About 35.

*Distribution*:—There are two important cultivated forms of wide distribution. The wild forms are spread over the tropics of Asia, Africa and America.

Capsule short . . . . .	1. <i>C. antichorus</i> .
Capsule elongate . . . . .	
Capsule scabrous or aculeate, 3-angled, beak short, erect . . . . .	2. <i>C. trilocularis</i> .
Capsule glabrous, cylindric, 10-ribbed, beak long, erect . . . . .	3. <i>C. olitorius</i> .

**1. *Corchorus antichorus* (L.) Ræuschel** Nom. Bot. ed 3. p. 158; Anders. Journ. Linn. Soc. V, Suppl. p. 10; Boiss. Fl. Or. I, 846; Hook. Fl. Brit. Ind. I, 398; Oliv. Fl. trop. Afr. I, 263.

*Antichorus depressus* L. Mant. p. 64; DC. Prodr. I, 504.

*Corchorus microphyllus* Fresen. in Mus. Senckenb. II, 156.

*Corchorus humilis* Munro Hort. Agrens. Append. p. 35.

*Jussiaea edulis* Forsk. Fl. Aeg-Arab. p. 210.

*Arabic name*:—Ueki.

*Description*:—A woody perennial, 6—9 inches high, prostrate, much-branched from the base; branches twisted, imbricate, woody. Leaves  $\frac{1}{4}$ — $\frac{3}{4}$  by  $\frac{1}{4}$ — $\frac{1}{2}$  inch, roundish, usually wrinkled, glabrous, irregularly crenate-serrate, base rounded or cuneate; petioles  $\frac{1}{2}$ —1 inch long; stipules subulate.

Flowers numerous, on leaf-opposed cymes; buds obovoid, apiculate; bracts lanceolate-subulate; peduncles and pedicels very short. Sepals linear-oblong, apiculate. Petals oblong, obovate.

Capsule  $\frac{3}{8}$ — $\frac{5}{8}$  inch long, cylindric, beaked, glabrous or hispidulous, often curved upwards, 4-valved. Seeds trigonous, black.

*Fruits*:—October (Marchesetti), January 1880 (Balfour).

*Locality* :—Plain of Maala (Defl.); Goldmore Valley (Schweinf.); slope of the Shum Shum Range (Ellenbeck); great valley between Steamer Point and town (Marchesetti); without locality (Hook., Madden, Anders., Birdw., Hildebrandt).

*Distribution* :—Cape Verd Islands, N. Africa, S. Arabia, Mascat, Afghanistan, Sind, Deccan.

**2. *Corchorus trilocularis* L.** Mant. p. 77; DC. Prodr. I, 504; Harv.-Sond. Fl. Cap. I, 229; Oliv. Fl. trop. Afr. I, 262; Fl. Br. Ind. I, 397; Boiss. Fl. Or. I, 845; Cooke Fl. Bomb. Presid. I, 149.

*Arabic name* :—Melochia.

*Description* :—Annual; stems and branches more or less hairy. Leaves 1—4 by  $\frac{3}{4}$ — $1\frac{1}{4}$  inches, elliptic or oblong-lanceolate, acute or obtuse, serrate (the lower serratures often destitute of filiform appendages), somewhat rough below, base rounded or cuneate; petioles  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, pilose; stipules lanceolate-subulate.

Flowers in short cymes; buds ovoid or obovoid apiculate; bracts lanceolate-subulate; peduncles very short, leaf-opposed, hairy; pedicels very short, pubescent. Sepals  $\frac{1}{4}$  inch long, linear-oblong, acuminate. Petals oblong, slightly longer than the sepals.

Capsules 2—3 inches long, with a short erect beak, hairy when young with stiff stellate hairs, scabrous when old, 3—4-angled, 3—4-valved; valves with transverse partitions between the seeds. Seeds trigonous, black.

*Locality* :—Crater of Shum Shum Range, Koosaf Valley (Defl.).

*Distribution* :—Tropical and S. Africa, S. Arabia, Afghanistan, Sind.

**3. *Corchorus olitorius* Linn.** Sp. Pl. (1753) p. 529; Forsk. Fl. Aeg.-Arab. (1775) 101; Lamk. Encycl. Bot. (1786) II, 103, t. 478, f. 1; Bot. Mag. (1828) IV, pl. 2810 (fruit a little too pointed); DC. Prodr. I, 511; Oliv. Fl. trop. Afr. I, 262; Hook Fl. Brit. Ind. I, 347; Boiss. Fl. Or. I, 845; Trim. Fl. Ceyl. I, 182; K. Schum. in Engl. & Prantl Pflanzenf. III, part 6, p. 19; Cooke Fl. Bomb. Pres. I. 149.

*Corchorus decemangularis* Roxb. Fl. Ind. II, 582.

Of ante-Linnean writers we may mention: Camerarius, Hort. Med. (1588) p. 47, f. 12; Prosper Alpinus, De Pl. Aegypti (1592) p. 39 et t.; Parkinson Theatr. Bot. (1640) p. 309 et fig.; Plukenet, Alm. Bot. (1696), p. 17; Phyt., t. 127, f. 3 and 4.

Bichter, Codex Bot. Linn. (1840) p. 525 shows that Linn. first included Plukenet t. 127, fig. 3 under this species and subsequently placed it under *Corchorus aestuans* (Sp. Pl. 1762, p. 746); but Linn. cites in addition Browne, *Triumfetta*, in Nat. Hist. Jam. 332, t. 25, fig. 1; this plate, however, in Watt's opinion, is rather *Corchorus acutangulus*.

*Arabic name* :—Molochia or melochia, muluhhiye.

*English name* :—Jute (from the Sanskrit 'juta' or 'jata')\* ; Jew's Mallow.

*Description* :—Annual, 3—4 feet high, much branched ; stems glabrous. Leaves  $2\frac{1}{2}$ —4 by  $1\frac{1}{2}$ —2 inches, elliptic-lanceolate, acute or acuminate, glabrous, serrate, the lower serratures on each side prolonged into a filiform appendage over  $\frac{1}{4}$  inch long, rounded at the base, 3—5-nerved ; petioles  $\frac{3}{4}$ —1 inch long, slightly hairy, especially towards the apex ; stipules subulate,  $\frac{1}{4}$ — $\frac{1}{2}$  inch long.

Flowers pale yellow, buds obovoid, angled, cuspidate ; bracts lanceolate ; peduncle shorter than the petiole ; pedicels 1—3, very short. Sepals  $\frac{1}{2}$  inch long, oblong, apiculate. Petals  $\frac{1}{6}$  inch long, oblong-spathulate. Style short ; stigma microscopically papillose.

Capsules  $1\frac{1}{4}$ — $2\frac{1}{4}$  inches long, linear cylindric, erect, 10-ribbed, beaked, glabrous ; cells and valves generally four, but five not uncommon ; valves with transverse partitions between the seeds. Seeds trigonous, black.

*Locality* :—Gravelly slope of the Shum Shum Range (Ellenbeck) ; without locality (Birdw.).

*Distribution* :—It is stated in Hooker's *Flora of British India*, that this species is indigenous in many parts of India, and distributed by cultivation to all tropical countries. Watt, however, thinks, that its claim to being strictly speaking indigenous in India rests on doubtful evidence.

*Note* :—It will be well to remember a remark made by Watt on the great variability of the fruit of the cultivated species of *Corchorus* : " It seems, in fact, probable that the peculiarities of the seed are much more constant than the shape of the fruit or the number of its carpels and valves. It is thus highly likely that this [*C. capsularis* Linn.] as also the next form [*C. olitorius* Linn.] are but cultivated conditions unworthy of the specific positions usually assigned to them. They are at all events each representative of groups of cultivated races that vary in colour of stem, shape of leaf, degree of hairiness, size of flower, shape and number of valves of fruit, etc., etc., until a panorama of specimens might be assorted that would not only break down the separation of *capsularis* from *olitorius* but might even endanger the positions of *C. trilocularis* and *C. acutangulus*. This much is certain, namely, that if specimens be

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\* According to Skeat, Dutt and others two other names are mentioned by Sanskrit authors, viz., 'patta' and 'kalasaka,' but the plant is by no means very clearly nor fully indicated in the classic literature of India. In the Indian vernaculars it is the pat, jhut, jhoto, jhuto, etc.



furnished in flower but not in fruit, the two chief jute plants can with difficulty be separately distinguished." *Commerc. Prod.* p. 406

*Economic and medicinal uses* : Cf. Watt, *Dict. Econ. Prod.* II, 524—62, IV, 558—60 ; *Commerc. Prod. Ind.* p. 405—427, Ibn-el-Beithar III, 338.

## XI.—ZYGOPHYLLACEÆ.

Herbs or shrubs, rarely trees, with divaricate jointed branches. Leaves opposite or alternate, stipulate, 1—3-foliate ; stipules in pairs, persistent, sometimes spiny.

Flowers hermaphrodite, regular or irregular, pedunculate, solitary or geminate, apparently axillary. Sepals usually 5, free or nearly so. Petals as many, free, hypogynous, imbricate or contorted, rarely valvate. Stamens as many as the petals or twice, rarely thrice as many, inserted at the base of the disk, those opposite to the petals often connate at the base with the claw of the petals ; filaments often with a minute scale at or near the base ; anthers versatile, dehiscing longitudinally. Ovary usually 5-sulcate, 5- or 10-celled. Style simple or styles 5, radiating ; stigma terminal, simple or 5—10-lobed. Ovules 1—2 or more in each cell.

Fruit various, never baccate, crustaceous or coriaceous, often separating into as many dehiscent or indehiscent cocci as there are carpels, sometimes spinose or winged. Seeds usually pendulous and solitary in each cell, oblong or linear ; raphe adnate or free ; testa membranous, crustaceous or thick and mucilaginous ; albumen scanty, rarely absent ; embryo as long as the seed, straight or rarely curved ; cotyledons oblong or linear, thick or foliaceous ; radicle short, straight, superior.

*Genera* 17. *Species* about 100.

*Distribution* :—Tropical and warm regions of both hemispheres, rare in tropical Africa.

Leaves abruptly pinnate ; filaments naked . . . .	1. Tribulus.
Leaves 1—2-foliate ; filaments with a scale . . . .	2. Zygophyllum.
Leaves 3—1-foliate ; filaments naked . . . .	3. Fagonia.

### 1. Tribulus L.

Ascending or prostrate, branching, usually pilose or hispid herbs. Leaves opposite, one in each pair smaller, abruptly pinnate, stipulate.

Flowers solitary, pseudo-axillary, pedunculate, white or yellow. Sepals 5, imbricate. Petals 5, spreading, imbricate, fugacious. Disk annular, 10-lobed. Stamens 10, rarely 5, inserted on the base of the disk, the longer opposite to the petals, the 5 shorter with a small gland

outside. Ovary sessile, hirsute, 5-12-lobed, 5-12-celled; ovules 1-5 in each cell, superposed; style short, pyramidal or filiform; stigmas 5-12.

Fruit 5-angled, of 5-12 winged or spinous or tuberculate indehiscent cocci. Seeds obliquely pendulous; testa membranous; embryo exalbuminous; cotyledons oval; radicle short.

*Species* about 20.

*Distribution*:—Warmer regions of the globe.

**1. *Tribulus terrestris* L.** Sp. Pl. (1753) p. 387; DC. Prodr. I, 703; Boiss. Fl. Or. I, 902; Oliv. Fl. trop. Afr. I, 283; Hook. Fl. Brit. Ind. I, 423; Franch. Sert. Somal. in Miss. Révoil 22.

*Tribulus albus* Poir.; DC. I, 703.

*Tribulus humifusus* Schum. et Thonn. Guin. Pl., p. 215.

*Tribulus Kotschyanus* Boiss. Diag. Pl. Or. ser II, I, 111.

*Tribulus mollis* Ehrenbg. in Schweinf. Fl. Aethiop. p. 29.

*Tribulus excrucians* Wawr. et Peyr. Sert. Beng. p. 17.

*Tribulus lanuginosus* L. Sp. Pl. (1753) p. 387.

*Description*:—A spreading, prostrate or decumbent annual, occasionally more or less frutescent below and persisting 2 or more years; stems and branches pilose; young parts silky-villous. Leaves opposite, abruptly pinnate; stipules lanceolate, hairy; leaflets 3—6 pairs, oblong, mucronate, sericeo-villous, base rounded oblique.

Flowers pseudo-axillary or leaf-opposed, solitary. Sepals  $\frac{1}{4}$  inch long, lanceolate, acute, hairy. Petals  $\frac{3}{8}$  inch long, oblong-obovate; claw short, hairy. Ovary bristly; style short, stout.

Fruit globose, consisting of 5 hairy or nearly glabrous, often muricate woody cocci, each with 2 pairs of hard, sharp spines. Seeds several in each coccus, with transverse partitions between them.

*Locality*:—Aden (Birdw.).

*Distribution*:—Tropics of the Old World, Southern Europe, Australia, Sind.

## 2. *Zygophyllum* L.

Frutescent herbs or shrubs, erect or prostrate, often spinose. Leaves opposite, 1—2-foliate, often fleshy. Stipules 2, often spiny.

Sepals 5 or 4, imbricate. Petals as many, unguiculate, imbricate and contorted. Disk fleshy, angular, cup-shaped or concave. Stamens 10-8, inserted at the base of the disk, longer than the petals; filaments filiform, with a scale at the base within; anthers oblong. Ovary sessile, 4-5-gonous, 4-5-celled, attenuated into an angled style; stigma minute. Ovules 2 to many in each cell, superposed.

Fruit capsular, 4-5-gonous or 4-5-winged, indehiscent, or septically dehiscent into 5 cocci, or loculicidally 5-valved. Seeds 1 or more in each cell, pendulous; testa crustaceous; albumen scanty; cotyledons oblong.

*Species* about 54.

*Distribution*:—Chiefly Australia, extra-tropical Africa, deserts of W. Asia.

**1. *Zygophyllum simplex*** L. Mant. p. 64; DC. Prodr. I, 705; Anders. Journ. Linn. Soc. V, Suppl. p. 13; Boiss. Fl. Or. I, 912; Hook. Fl. Brit. Ind. I, 424; Oliv. Fl. trop. Afr. I, 286.

*Zygophyllum portulacoides* Forsk. Fl. Aeg.-Arab. p. 88.

*Description*:—A much-branched, succulent, watery, procumbent herb; branches slender, reddish, striate. Leaves small, subsessile, cylindric, oblong, or obovate, obtuse, fleshy; stipules lanceolate, acute.

Sepals obovate, cucullate at the apex. Petals yellow, spathulate, spreading, margins flat. Ovary turbinate, glabrous, ribbed; style tapering.

Capsules deflexed, rugulose, separating into 5 compressed 3-5-seeded cocci. Seeds minute, oblong, attenuated at both ends.

*Fruits*:—February 1851 (Thomson), March 1878 (Perry), April 1861 (Thomson).

*Locality*:—Plain of Maala, hill near Steamer Point (Defl.); near the coal dépôt of the Messag. Marit. on basaltic rubbish (Schweinf.); on the slope of the Shum Shum Range (Elenbeck, Busse, Marchesetti); great valley between Steamer Point and town (Marchesetti); without locality (Edgew., Thomson, Hook., Madden, Anders., Birdw., Perry, Kuntze). Very common.

*Distribution*:—Cape Verd Islands, Egypt, Palestine, Nubia, Arabia, highlands of Somaliland, Sind, Cape of Good Hope, S.-W. Africa.

### 3. *Fagonia* L.

Much-branched spinose herbs, woody at the base, erect or prostrate. Leaves opposite, 1-3-foliate; leaflets entire, mucronate; stipules often spiny. Peduncles solitary, 1-flowered, apparently axillary.

Flowers rosy or violet, rarely yellow. Sepals 5, deciduous, imbricate. Petals 5. Stamens 10; filaments filiform, naked; anthers shortly oblong. Ovary sessile, 5-gonous, 5-celled; ovules 2, collateral, pendulous from cending funicles. Stigma simple.

Fruit 5-gonous, of 5 one-seeded cocci which separate from a horny endocarp. Seeds erect, compressed, broadly oblong; testa mucilaginous; albumen horny; cotyledons broad, flat, ovate.

*Species* about 7.

*Distribution*.—Widely distributed throughout the Mediterranean and the Eastern regions, rarer in S. Africa, California, Chili.

Flowers pale rose-coloured—

Leaves 1-3-foliate; fruit deeply 5-partite	.	.	.	1. <i>F. cretica</i> .
Leaves 1-foliate; fruit not deeply 5-partite	.	.	.	2. <i>F. parviflora</i> .
Flowers white	.	.	.	3. <i>F. glabra</i> .

**1. *Fagonia cretica*** Linn. Sp. Pl. (1753) 386; DC. Prodr. I, 704; Anders. Journ. Linn. Soc. V, Suppl. p. 11; Boiss. Fl. Or. I, 905; Oliv. Fl. trop. Afr. I, 287.

*Fagonia Hispanica* Linn. Sp. Pl. (1753) 386.

*F. arabica* Linn. l. c.

*F. glutinosa* Delil. Fl. Aeg. 86, t. 28.

*F. mollis* Delil. l. c. 76, t. 27, f. 2.

*F. latifolia* Delil. l. c. 86, t. 28, f. 3.

*F. cistoides* Delil. in Herb. Bové, n. 169.

*F. Mysorensis* Roth N. Sp. 215.

*F. Oliveri* DC. Prodr. I, 704.

*F. Persica* DC. l. c.

*F. Bruguieri* DC. l. c.

*F. acerosa* Boiss. Diag. Pl. Or. VIII, 124.

*F. Aucheri* Boiss. l. c. I, 62.

*F. echinella* Boiss. l. c. VIII, 123.

*F. grandiflora* Boiss. l. c. 121.

*F. Kahirana* Boiss. l. c. 122.

*F. myricantha* Boiss. l. c. 123.

*F. Sinaica* Boiss. l. c. 61.

*F. subinermis* l. c. 62.

*F. Thebaica* Boiss. l. c. 121.

*F. Californica* Benth. Bot. Sulph. Voy. 10.

*F. Chilensis* Hook. et Arn. in Bot. Misc. III, 165.

*F. virens* Coss in Kralik. Pl. Alger.

*F. fruticans* Coss. l. c.

*F. diversifolia* Boiss. in Pl. Or. nov. ser. II, 113.

*Arabic name*.—Shoeka, shuki.

*Description*.—An erect or ascending, diffuse or densely-branched spinose annual, from a few inches to a foot or more in height, glandular puberulous, scabrid or glabrescent. Leaves opposite, 1-3-foliate;

petioles deeply striate; stipules 2 pairs of sharp thorns; leaflets linear, acute, sessile or with short petiolules.

Flowers pale rose-coloured. Sepals ovate, aristate. Petals twice as long as the sepals, spathulate; claw long. Ovary hairy; style tapering.

Fruit glandular pubescent, rounded at the base, pyramidal towards the apex, deeply 5-partite almost to the axis. Seeds ovoid, acute, flattened, smooth.

*Fruits*:—December 1847 (Hooker), March 1878 (Perry), April 1861 (Thomson).

*Locality*:—On the slope of the Shum Shum Range (Edgew., Hook, Anders., Balf., Ellenbeck); great valley between Steamer Point and town (Marchesetti); without locality (Birdw., Perry, Schweinf.).

*Distribution*:—Both shores of the Mediterranean, in S. extra-tropical Africa, warmer dry parts of Asia, Western N. and S. America.

*Note*:—The form and size of the leaves and stipules of *Fagonia cretica* are very variable; sometimes the leaves are nearly absent, and their place is supplied by the long and hard spiny stipules; in other cases the leaves are for the most part simple with inconspicuous stipules, but in some states of this variety the leaves are nearly elliptical and the spines exceed the leaves in length. There is also great difference in the amount of general pubescence; it varies from nearly perfect smoothness to viscosity.

The specimens collected by Hooker and Thomson are named *var. subinermis* Boiss. in the Kew Herbarium. We prefer to drop this varietal name; there would be no end of varieties, if we wanted to describe all the different forms of this extremely variable plant.

## 2. *Fagonia parviflora* Boiss. Diag. Pl. Or. ser. I, VIII, 124.

*Var. brevispina* Schweinf. Bull. Herb. Boiss. VII, App. II, p. 274.

*Description*:—A small shrub, about  $1\frac{1}{2}$  feet high, prostrate at the base, forming extensive bushes, glabrous or puberulous in the upper parts when examined under the magnifying glass, biennial or perennial; internodes of old stems very long,  $\frac{4}{5}$ — $1\frac{3}{5}$  inches long; branches prostrate, divaricate, terete, striate; stipules 2 pairs of slender thorns, often unequal, short, measuring up to  $\frac{1}{5}$  inch in the lower parts and almost invisible in the uppermost. Leaves unifoliate, elongate, elliptic-acute, short-petioled on the young lateral branches and  $\frac{2}{5}$  inch long and  $\frac{1}{5}$  inch broad; on the upper young branches linear,  $\frac{1}{5}$ — $\frac{1}{12}$  inch long.

Flowers axillary, very small, shorter than the pedicels. Sepals triangular-lanceolate, papillose, mucronate, half as long as the corolla. Petals pale rose-coloured. Capsule globose-turbinate, hirsute, usually as

long as the deflexed pedicel, apiculate with the short style; carpels 5, carinate.

*Flowers and fruits* in November and December (Schweinf.).

*Locality*:—Ravine north of the telegraph office of Steamer Point, above the coal depôt of the Messag. Marit. (Schweinf.); plain of Maala, Goldmore Valley, ravine south-west of the Tower of Silence (Defl.); on the way to the Shum Shum Range at a height of about 650 feet, below the top of the Shum Shum (Busse).

*Distribution* of the type: Nubia, Upper Egypt, Abyssinia, S. Arabia, S. Persia.

*Note*:—Schweinfurth found the same variety on the island of Macour on the Nubian coast (21° N. L), where the plant occurs on coral débris under similar conditions (Krause).

**3. *Fagonia glabra* Krause** in Engl. Bot. Jahrb. XXXV, Heft 5, p. 42.

*Description*:—A perennial much branched-herb; branches and leaves quite glabrous; younger branches striate; leaves with a very short petiole, simple, obovate, obtuse, cuneate at the base, thick coriaceous,  $\frac{3}{4}$ —1 inch long,  $\frac{7}{8}$ — $\frac{3}{4}$  inch broad; stipules spinose, thin, slightly unequal, often longer than the leaves.

Flowers short-pedicellate, axillary, solitary. Sepals  $\frac{1}{8}$  inch long, narrow obovate, acuminate, shortly ciliate. Petals  $\frac{1}{4}$  inch long, white, obovate, twice as long as the calyx.

Fruit pubescent.

*Locality*:—On rocks of the Shum Shum Range at a height of about 1,000 feet, and near the top at about 1,700 feet (W. Busse, n. 2062).

Endemic in Aden.

*Note*:—*F. glabra* Krause approaches nearest to *F. socotrana* (Balf.) Engl. from which, however, it is sufficiently distinguished by the spinose stipules. It differs from *F. Luntii* Bak. and *F. nummularifolia* Bak. (both from Hadramaut) by the leaves being entirely glabrous and by the colour of the flowers. (Krause.) We have not seen this plant.

## XII.—GERANIACEÆ.

Herbs, undershrubs, rarely trees, often glandularly pubescent. Leaves opposite or alternate, rarely entire, often 2—stipulate.

Flowers hermaphrodite, regular or irregular, solitary, umbelled, cymose or racemose; peduncles usually axillary. Sepals 5, rarely fewer, free or united to the middle, usually imbricate, the posticous sometimes spurred, persistent or rarely deciduous. Petals as many as the sepals, fewer by suppression or 0, hypogynous or sub-perigynous, variously

imbricate, rarely contorted. Torus scarcely expanded into a disk, with 5 glands alternating with the petals, or eglandular, raised in the centre, rarely flat. Stamens as many or twice as many (rarely thrice as many) as the sepals; filaments filiform or dilated or connate into a ring; anthers versatile, 2-celled; cells parallel, dehiscing longitudinally. Ovary 3-5- (rarely 2-) lobed, 3—5-celled. Carpels united with the axis as far as the insertion of the ovules, prolonged above into a styliferous beak or into styles which are more or less united; stigmas capitate, linear or ligulate; ovules 1—2 or many in each cell, anatropous, pendulous; raphe ventral.

Fruit capsular, 3—5-lobed; lobes 1-seeded, often separating from the axis, septicidal or loculicidal; rarely berried. Seeds pendulous, horizontal or ascending, usually exarillate; testa membranous, rarely subcrustaceous; albumen scanty or absent, rarely thick and fleshy; embryo straight or curved; cotyledons flat, planoconvex or variously folded, foliaceous or thick, rarely fleshy; radicle short, straight, looking towards the hilum, or longer, inflexed or usually incumbent on the cotyledons.

*Genera* 20; *species* about 800.

*Distribution* :—Temperate and subtropical regions of both hemispheres.

### 1. *Erodium* L'Herit.

Herbs, rarely undershrubs; branches swollen or jointed at the nodes. Leaves usually pinnately divided.

Flowers regular or irregular; peduncles axillary, umbelled at the apex, rarely 1-flowered. Sepals 5, imbricate. Petals 5, hypogynous, imbricate, with alternating glands. Stamens 5, alternating with 5 staminodes. Ovary 5-lobed, 5-celled, beaked, the beak running into a style with 5 longitudinally stigmatose branches; ovules 2 in each cell, more or less superposed.

Lobes of the capsule 1-seeded, separating septifragally from the axis, the beaks rolling up elastically from the base to the apex, hairy on the inner surface, each with usually 2 pits at the top below the beak. Seeds exalbuminous; embryo incumbent on the induplicate or flexuose radicle.

*Species* about 50.

*Distribution* :—Chiefly in temperate regions in the northern hemisphere of the Old World.

1. *Erodium malacoides* (L) Willd. Phyt. I (1794) 10; Willd. Spec. Pl. III (1800) 639; DC. Fl. Franc. IV (1805) 842; DC. Prodr. I (1824) 648 n. 34; Sibth. et Smith, Fl. Graec. VII (1830) 53, t. 658; Koch Synops. Fl. Germ. ed. I, (1837) 142; Gren. et Godr. Fl. France I (1848) 308; Boiss. Fl. Or. I (1867) 893; Willk. et Lange, Prodr. Fl.

Hisp. III (1880) 538; Batt. et Trab. Fl. de l'Alg. II (1888) 127; A. Gray Syn. Fl. N. Am. I, 1. (1897) 362; Halacsy Consp. Fl. Graec. I (1901) 305; Bub. Fl. Pyren. III (1901) 319; Brumh. Mon. Uebers. Erod. (1905) 45; Knuth Geraniac. in Engler Regni Veg. Consp. IV, 129 (1912) p. 245.

*Erodium malacoides* var.  $\alpha$  Ait. Hort. Kew. ed. 1, II (1789) 415.

*Erodium malacoides* var. *macrophyllum* Lange in Willk. et Lange. Prodr. Fl. Hisp. III (1880) 538.

*Erodium glabellum* Del. Fl. Aegypt. III (1813) 20.

*Erodium althæoides* Jord. Pugill. Pl. nov. (1852) 41.

*Erodium malvaceum* Jord. Pugill. Pl. nov. (1852) 41; Loret et Barrand. Fl. Monsp. (1876) 122.

*Erodium glutinosum* Dulac Fl. Hautes-Pyr. (1867) 238.

*Erodium stipulaceum* Duf. ex Nym. Consp. (1878—82) 139.

*Erodium floribundum* Batt. in Bull. Soc. Bot. France XXX (1883) 265; Batt. et Trab. Fl. de l'Alg. II (1888) 128.

*Geranium malacoides* L. Spec. Pl. ed. 1. II (1753) 680, ed. 2. II (1763), 952; Burm. Spec. Geran. (1759) 31; Forsk. Fl. Aegypt.-Arab. (1775) 123; Cav. Diss. IV (1787) 220, tab. 91, f. 1.

*Herodium malacoides* Reichb. Ic. Fl. Germ. III (1842—43) 65, t. 185, f. 4868.

*Description*:—Annual, softly hairy, hairs on the stem deflexed. Stem erect or diffuse, elongate, branched. Leaves ovate-oblong, acute or obtuse, shortly appressed-pubescent, lower cordate; stipules large, scarious, acute or obtuse.

Inflorescence glandular; peduncles 3-many-flowered; bracts ovate, scarious, ciliate. Sepals membranous, two outer 5- and three inner 3-nerved, awn hairy. Petals ciliate at the base, obovate, lilac, 9-nerved. Filaments glabrous, lanceolate. Staminodes linear. Ovary hairy.

Carpels stipitate, 3-gonous, setose; beak 4-5-times as long as the cell, with stiff brown hairs for  $\frac{1}{4}$  of its length; pits with a deep fold.

*Locality*:—Sandy seashore (Madden).

*Distribution*:—All over the Mediterranean Region (Spain, Portugal, S. France, Italy, Dalmatia, Western Asia, Syria, Egypt, Algeria, Morocco), Madeira, Island of Kishm in the southern Persian Gulf.

Naturalized in the S.-W. Cape Region, South America (Argentina, Peru) N. America.

*Note*:—No botanist after Madden, who found *Erodium malacoides* in 1850, has ever seen the plant in Aden. As this species has never been reported to occur in Arabia, it is quite probable that at no time was it indigenous in Aden.



## XIII.—MELIACEÆ.

Trees or shrubs. Leaves alternate, exstipulate, usually pinnate; leaves or leaflets usually entire.

Flowers regular, usually hermaphrodite, in terminal or axillary panicles. Calyx usually small, 4-5-fid or—partite, imbricate, rarely valvate. Petals 4—6 (rarely 3—7), sometimes free and contorted or imbricate, sometimes connate or adnate to the staminal tube and valvate. Stamens 4—10, generally 8—10 (very rarely more), inserted with the petals outside of the base of a hypogynous disk; filaments united by their margins into a more or less complete tube which is entire, toothed or variously laciniate, rarely free; anthers introrse or versatile, erect, usually sessile on the staminal tube, included or exserted, 2-celled, dehiscing longitudinally; connective sometimes produced. Disk various, usually annular, or tubular, and sheathing, free or adnate to the ovary or staminal tube, or 0. Ovary usually free, 2—5-celled; ovules 1—2 (rarely more) in each cell, collateral or superposed; raphe ventral, micropyle superior; style simple; stigma disciform or capitate.

Fruit capsular, baccate or drupaceous. Seeds exalbuminous or with fleshy albumen, winged or not; embryo flat; hilum usually ventral; cotyledons fleshy.

*Genera* 37; *species* about 300.

*Distribution*:—Frequent in the warm regions of Asia and America, rarer in Africa.

Seeds albuminous; cotyledons foliaceous . . . . . 1. *Melia*

Seeds exalbuminous; cotyledons thick . . . . . 2. *Azadirachta*.

The two species described below are not indigenous in the Aden territory.

1. *Melia* Linn.

Trees or shrubs. Leaves alternate, simply or 2-3-pinnate with an odd one, the young ones often stellately tomentose; leaflets toothed, serrate or entire.

Flowers hermaphrodite, elongate, in large many-flowered axillary much-branched panicles. Calyx 5—6 partite, imbricate. Petals 5—6, free, much exceeding the calyx. Staminal tube a little shorter than the petals, laciniate the mouth dilated; anthers 10, within the staminal tube at its apex, sessile between its laciniae, erect. Disk annular. Ovary 5—8-celled; cells opposite the sepals; ovules 2 in each cell, superposed; style cylindric, much exceeding the ovary; stigma capitate.

Drupe subfleshy; endocarp woody; cells 1-seeded. Seeds pendulous, elliptic; testa crustaceous; albumen fleshy or scanty; cotyledons foliaceous; radicle terete, superior.

*Species* about 12.

*Distribution*:—Tropical Asia and Africa.

1. *Melia Azedarach* Linn. Sp. Pl. (1753) 384; Grah. Cat. Bomb. Pl. 30; Harms in Engl. & Prantl Pflanzenfam. III, part IV, 287, fig. 160, A—L; Boiss. Fl. Or. I, 954; Oliver Fl. trop. Afr. I, 332; Hook. Fl. Brit. Ind. I, 544; Cooke Fl. Bomb. Pres. I, 205.

*Melia angustifolia* Schum. & Thonn. Beskr. Guin. Pl. 214.

*Melia australis* Sw. Hort. Brit. ed. 2, 85.

*Melia Bukayun* Royle Illustr. Bot. Himal. 144; Griff. Itin. Notes 355, 403.

*Melia cochinchinensis* M. Roem. Syn. Hesper. 95.

*Melia Commelini* Medic. ex Steud. Nomencl. ed. 2, II. 118.

*Melia composita* Benth. Fl. Austral. I, 380.

*Melia florida* Salisb. Prodr. 317.

*Melia guineensis* G. Don in Lond. Hort. Brit. 168.

*Melia Japonica* G. Don Gen. Syst. I, 680.

*Melia orientalis* M. Roem. Syn. Hesper. 95.

*Melia sambucina* Blume Bijdr. 162.

*Melia sempervirens* Sw. Prodr. Veg. Ind. Occ. 67; Roxb. Hort.

Beng. 33; Fl. Ind. II, 395; Wall. Cat. 1252; Dalz. and Gibs.

Bomb. Fl. Suppl. 15.

*Arabic name*:—Ssile-asadiracht.

*English names*:—Persian Lilac, Bastard Cedar, Bead Tree.

*Description*:—A tree, reaching 40 feet. Leaves impari-bi- (or sometimes tri-) pinnate, 9—18 inches long; pinnæ opposite or alternate; ultimate leaflets 3—11, opposite or nearly so,  $\frac{1}{2}$ —2 by  $\frac{1}{4}$ —1 inch, ovate or lanceolate, acuminate, obtusely serrate, sometimes lobed, glabrous on both surfaces, slightly inequilateral at the base; petioles short, slender.

Flowers fragrant, lilac, in long peduncled axillary panicles which are shorter than the leaves and glabrous or sparsely puberulous; pedicels slender. Calyx pubescent outside, divided nearly to the base; lobes ovate-oblong, acute, ciliolate. Petals  $\frac{5}{8}$  inch long, oblong-lanceolate. Staminal tube purple,  $\frac{5}{16}$  inch long, glabrous, slightly ribbed outside, faintly pubescent within, acutely 20-toothed; anthers sessile, glabrous, apiculate, 1 between each pair of teeth. Ovary glabrous, 5-celled.

Drupe ellipsoid-globose, 4-seeded.

*Locality*:—Shaikh Othman (Defl.). Naturalized.

*Distribution*:—Widely dispersed by cultivation in warm countries; supposed to be indigenous in Baluchistan and the Jhelum Valley in Kashmir (Brandis).

*Uses* :—This plant yields a brown adhesive gum and the seeds afford a fixed oil. By the Arabs and Persians it has long been used as a medicine.

The wood is handsomely marked and takes an excellent polish.

## 2. *Azadirachta A. Juss.*

Trees. Leaves alternate, imparipinnate ; leaflets serrate.

Flowers hermaphrodite, in axillary panicles. Calyx 5-partite. Petals 5, much exceeding the calyx, free, imbricate. Staminal tube a little shorter than the petals, laciniate at the apex ; anthers within the tube at its apex, sessile, opposite to the laciniae. Disk 0. Ovary 3-celled, the cells opposite the petals ; ovules 2 in each cell, collateral ; style much exceeding the ovary ; stigma shortly cylindric, 3-toothed.

Drupe 1-seeded, endocarp woody. Seed exalbuminous, ellipsoid ; cotyledons very thick and fleshy, acutely 2-lobed at the base ; radicle exserted from the cotyledons, superior.

*Species* 1.

*Distribution* :—Wild in the dry region of the Irawadi valley from Prome upwards ; cultivated and naturalized in many hot climates.

**1. *Azadirachta indica* A. Juss.** Mém. Mél. (1830) 68, t. 2, n. 5 ; C. DC. in DC. Monogr. Phan. I, 459, t. 6, fig. 10 ; W. & A. Prodr. I, 118 ; Wight Ic. t. 17 ; Grah. Cat. Bomb. Pl. 30 ; Dalz. and Gibs. Bomb. Fl. 36 ; Trim. Fl. Ceyl. I, 244 ; Harms in Engl. & Prantl Pflanzenfam. III, part IV, 287, fig. 160, M—S ; Cooke Fl. Bomb. Pres. I, 207 ; Brandis Ind. Trees 139.

*Melia Azadirachta* Linn. Sp. Pl. 385 ; Roxb. Hort. Beng. 33 ; Fl. Ind. II, 394 ; Griff. Notulæ IV, 500 ; Wall. Cat. 1251 ; Bedd. Fl. Sylv. t. 13 ; Hook. Fl. Brit. Ind. I, 544.

*Melia parviflora* Moon Cat. 35.

*Melia indica* Brandis For. Fl. 67.

*Melia fraxinifolia* Salisb. Prodr. 310.

*Melia japonica* Hassk. Cat. Hort. Bogor. Alt. 219.

*Melia pinnata* Stokes Bot. Mat. Med. II, 482.

*Arabic name* :—Neshem. *English name* : Neem or Margosa Tree.

*Description* :—A large tree, 40-50 feet high, with a straight trunk. Leaves simply pinnate, 8—15 inches long, crowded near the ends of the branches ; leaflets 9—12, subopposite, 1—3 by  $\frac{1}{2}$ — $1\frac{1}{2}$  inches, obliquely lanceolate, sometimes falcate, acuminate, serrate glabrous on both surfaces, base inequilateral, acute ; petiolules very short.

Flowers white, fragrant, in branched glabrous panicles shorter than the leaves; bracts minute, lanceolate, caducous. Calyx puberulous outside, divided almost to the base; lobes rotund-ovate, minutely ciliolate. Petals  $\frac{1}{4}$  inch long, obovate-oblong, faintly puberulous outside, ciliolate. Staminal tube glabrous, a little shorter than the petals, obconic, the laciniae truncate and toothed at the apex; anthers 10, opposite the laciniae and a little shorter than them, apiculate. Disk 0. Ovary glabrous, 3-celled, the cells opposite to the petals; ovules 2 in each cell, collateral; stigma 3-toothed, included in the tube.

Drupe the shape of an olive,  $\frac{1}{2}$ — $\frac{3}{4}$  inch, glabrous, 1-seeded

*Locality*:—Shaikh Othman (Busse ex Krause); naturalized.

*Uses*:—This tree is of considerable economic importance. "From the bark there exudes a bright amber-coloured gum, which is collected in small tears or fragments. This is said to constitute a portion of the commercial 'gum gattie,' and 'of East India Gum.' It is considerably esteemed medicinally as a stimulant. From the seeds a fixed acrid, bitter oil is extracted, of a deep yellow colour and disagreeable flavour. As an anthelmintic and antiseptic it is in much demand. The barks of trees are often painted with it to protect them from insect pests. By the women of Sind it is applied as a hair wash. In addition to the gum and oil, the bark, young fruits, seeds, leaves, flowers and sap have all medicinal properties assigned to them or are spoken of as edible. The leaves are utilised to preserve books, papers, cloths, etc., from ravages of insects. They are said, moreover, to be useful in keeping away mosquitoes. Hooper (Rept. Labor. Ind. Mus. Indust. Sec., 1903-04, 30-1) records the results of his investigations. Fresh leaves were distilled in water. It was found that a distinct allyl- or onion-smelling compound was present in the distillate. The powdered leaf, when burnt, gave off an odour found to prove fatal to insects. The extract of the leaves was intensely bitter and contained evidence of an alkaloid.

"The sap ... is yielded by the tree either spontaneously or is extracted artificially. In the former case, a clear and colourless liquid flows in a thin stream or continuous droppings from two, three or more parts of the plant simultaneously for several weeks on end. Artificially it is obtained by exposing a healthy-looking root, cutting it through, and placing a vessel beneath to receive the exuding liquor, which is a refrigerent, nutrient and alterative tonic. The wood is durable, has an average weight of 50 to 52 lb. per cubic foot. Its chief use is for cart-construction, ship-building, agricultural implements, and in South India for furniture. The twigs are largely used as tooth-brushes." Watt.

#### XIV.—BURSERACEÆ.

Resinous trees or shrubs. Leaves generally alternate, imparipinnate, 3-foliate, in some cases 1-foliate; stipules generally 0.

Flowers mostly small, hermaphrodite or polygamous, racemose or panicled. Calyx 3-5-fid or-partite, imbricate or valvate. Petals 3-5, imbricate or valvate. Stamens as many or twice as many as petals, inserted on the margin or on the outside of a fleshy disk; filaments free, rarely connate at the base; staminodes 0; anthers 2-celled, dehiscent longitudinally. Ovary free, 2-5-celled; ovules generally 2 in each cell, axile, usually pendulous, rarely ascending. Stigma undivided or 2-5-lobed.

Fruit drupaceous, either indehiscent with a 3-6-celled hard stone, or valvately dehiscent with several separate stones. Seeds pendulous; testa membranous; albumen 0; cotyledous often lobed, generally twisted or crumpled.

*Genera* 18; *species* over 300.

*Distribution*:—Tropics of both hemispheres.

Drupes indehiscent; pyrenes not separating	.	.	1. Commiphora.
Drupe dehiscent; pyrenes separating	.	.	2. Boswellia.

##### 1. *Commiphora* Jacq.

Small trees or shrubs, yielding aromatic resin. Branches often thorny. Leaves alternate, crowded at the ends of short branchlets, imparipinnate or 1-3-foliate.

Flowers polygamous fasciculate on thickened nodes or short lateral branchlets, or on 1-4-flowered, axillary, jointed peduncles. Calyx campanulate or shortly tubular, 3-4-toothed, persistent. Petals 3-4, erect or with recurved tips, linear or oblanceolate-oblong, valvate or with the sides slightly imbricate and tips incurved in æstivation. Stamens 8-10, inserted on or outside the margin of a cupuliform disk, alternately shorter. Ovary 3-celled, rarely 2-4-celled, narrowed into a short thick style; stigma obtuse, 3-4-lobed; ovules geminate, collateral, pendulous.

Fruit a drupe, ovoid or subglobose, the rind splitting more or less irregularly into 2-6 valves, leaving the pulp exposed, which encloses the nuts, which are bony, 1-seeded and partially connate. Seeds exalbuminous; embryo straight, the radicle pointing upwards; cotyledons thin, crumpled and plaited.

*Species* about 80.

*Distribution*:—Arabia, India, tropical and Southern Africa.

Leaves simple	.	.	.	1. <i>C. abyssinica</i> var. <i>simplicifolia</i> .
Leaves mostly compound	.	.	.	2. <i>C. opobalsamum</i> .

**1. *Commiphora abyssinica* Engl. in D.C. Prodr. Cont. IV, 10.**

*Balsamodendron abyssinicum* Berg in Bot. Zeit. (1862), p. 161.

*Balsamodendron Kafal* Herb. Schimper, n. 1359, A. Rich. (ex Engler).

*Balsamea abyssinica* Engl. in Bot. Jahrb. I, 41.

**Var. *simplicifolia* Schweinf. in Bull. Herb. Boiss. (1899) Append. II, p. 291.**

*Arabic name* :—Quafal, Chaddash (Schweinf.).

*Description* :—A small shrub ; branches virgate ; branchlets pale, spinous, glabrous. Leaves glabrous, scattered, simple, subsessile ; petiole very short.

Flowering branchlets short, about  $\frac{2}{5}$ — $1\frac{1}{5}$  inches long, mostly 3-flowered. Flowers very shortly peduncled ; bracts glanduloso-ciliate. Calyx slightly scabrous ; tube  $\frac{1}{16}$  inch long. Petals  $\frac{1}{4}$  inch long,  $\frac{1}{4}$  inch broad. Ovary ovoid,  $\frac{1}{24}$  inch long.

Drupe ovoid, acute,  $\frac{1}{2}$  inch long, about  $\frac{1}{3}$  inch broad.

*Fruits* in December (Schweinf.).

*Locality* :—Not far from the Flagstaff on top of the Shum Shum Range (Schweinf.).

*Distribution* (of the species) : Abyssinia, Kordofan, Eritrea, S. Arabia.

The variety (*simplicifolia* Schweinf.) has, besides, been observed in Yemen.

*Note* :—Some observations made by Schweinfurth might prove useful in the identification of *Commiphora abyssinica*, Engl.

It is important to remember that locality, season and age cause a good many deviations from the typical form and that in such cases one feels inclined to consider those aberrant forms as distinct and different species.

During the dry season and mostly also during the flowering and fruiting time the shrub is entirely leafless. The bark of the stem is quite smooth and covered with a shining and bright-leather-yellow epidermis which peels off in rather thick layers. In this respect *C. abyssinica* resembles perfectly *C. opobalsamum*, Engl. ; it is, however, easily recognized by the distinct odour of 'White Spruce' of its young branchlets.

The branches are dark grey, (their bark not shining), and either in the shape of long, unarmed and ascending shoots, or shortened, short-branched and armed with shorter and longer thorns. The short-stalked glabrous, thin, delicate leaves are either single on the long unarmed

shoots or fascicled at the ends of short unarmed branchlets, or even more or less approximate at the base of those short branches which are produced into a thorn.

In young 3-foliolate leaves of the typical plant the central leaflet is always considerably longer than the lateral ones. The leaflets are sessile. In the older leaves the length of the lateral leaflets is at the most  $\frac{1}{2}$  or  $\frac{1}{3}$  of the central one, and in other cases, especially in forms with pointed leaves,  $\frac{1}{4}$  or even  $\frac{1}{10}$ . The central leaflet is oblong-linear, oblong-obovate or oblong-elliptic with rounded apex in cases where the leaf consists only of one leaflet, but long-pointed in 3-foliolate leaves. The margin is usually crenate-serrate in all the leaflets, but forms with the margin entire can often be seen.

The flowers appear twice a year, either on the leafless branches where they form dense fascicles at the ends of the short branchlets seated on very short peduncles, or in axillary cymes between the fascicles of leaves. In the latter case the peduncles are longer and are about as long as the calyx. The triangular bracts are often glanduloso-ciliate; but all the other parts of the inflorescence are entirely glabrous. The calyx is shortly cup-shaped and divided into 3-angular teeth about half-way down during the time of flowering, and for about  $\frac{1}{3}$  during the time of fruiting. The petals are  $2-2\frac{1}{2}$  times as long as the calyx. The fruit is globular-oval and at least twice as long as the peduncle, which is generally reflexed and scarcely thickened.

The chief characteristics of *Commiphora abyssinica* may be summarized like this: Very short lateral leaflets; very short petioles; deeply divided calyx; oval outline of the fruit with well-developed pointed apex; glanduloso-ciliate bracts; smooth putamen with a transverse furrow at the apex.

*Uses*.—E. M. Holmes expressed his doubts (Pharmaceutical Journal, 12th December 1896) as to whether *Commiphora abyssinica* produces myrrh, because neither the bark nor the fruit showed a bitter taste. Schweinfurth, however, states that the bark of specimens collected at Badjil is decidedly bitter. In the same place as well as in other localities he observed that from incisions made in the bark there exuded a yellowish milky-opaque ("milchigtrüb") juice which, in the open air, soon hardened into the resin known as myrrh.

When Defflers travelled in the country of the Fadhlis in South Arabia, *Commiphora abyssinica* was pointed out to him as the plant from which great quantities of myrrh were brought to the market.

The degree of bitterishness may be different according to the season and the branching-region of the same plant.

**2. Commiphora opobalsamum** (Forsk.) Engl. in DC. Prodr. Cont. V, 16. **var. gileadense** Engl. l. c.

*Amyris opobalsamum* Forsk. Fl. Aegypt.-Arab., p. 79.

*Amyris gileadensis* Linn. Amoen. Acad. vii, 55; Vahl Symb. I, 28 t. 11.

*Balsamodendron opobalsamum* Kunth Gen. Terebinth. p. 16; Anders. Journ. Linn. Soc. V, Supplem. p. 13; Oliv. Fl. Trop. Afr. I, 326.

*Balsamodendron gileadense* Kunth l. c., p. 16; Ann. Sc. Nat. ser. 1, II, 349; DC. Prodr. II, 76; Nees Düss. t. 356, f. 1—3.

*Arabic names*:—Besham (Schweinf.), balasan (Watt).

*English names*:—Balsam of Mecca, Balm of Gilead.

*Description*:—Tree or shrub; branches virgate, divaricate, glabrous or the extremities and leaves occasionally finely pubescent, unarmed. Bark smooth, cinereous. Leaves scattered or in fascicles, ternate, rarely imparipinnate, 2-jugate, from short or suppressed lateral branchlets often under 1 inch in length; leaflets obovate or obovate-oblong, obtuse, lateral ones  $\frac{1}{4}$ — $\frac{2}{5}$  inch long,  $\frac{1}{5}$ — $\frac{1}{3}$  inch broad, the central one often twice as long; petioles  $\frac{2}{5}$ — $\frac{3}{5}$  inch long, slender.

Calyx campanulate, shortly 4-dentate.

Fruit ovoid or ellipsoidal, smooth, glabrous, apiculate.

*Locality*:—Goldmore Valley, above the coal-dépôt of the Messag. Marit. valley below the top of the Shum Shum Range (Schweinf.); plain between Maala and the Goldmore Valley, rather rare on the mountains where the shrub grows isolated in places of difficult access (Defl.); Shum Shum Range at a height of about 1,700 feet (Hook.); great valley between Steamer Point and town (Marchesetti); on the slope of the Shum Shum Range (Ellenbeck); Little Aden, plateau and dunes east of Jebel Ihsan (Defl.); without locality (Birdw., Kuntze).

*Distribution*:—Arabia, Nubia.

*Historical note*:—This far-famed product of the East is mentioned by both Jewish and classical writers. The tree belongs to the tropical region and can scarcely be counted amongst the products of the so-called Oriental flora.<sup>1</sup> It is very rare, difficult to cultivate and has gradually disappeared from various places where it was grown in former times.<sup>2</sup>

Josephus informs us that the balsam tree grew in the region round about Jericho, of which it was the most costly and valued product.<sup>3</sup> It was also cultivated at Engaddi. The same author mentions that the

<sup>1</sup> Schweinfurth, G. Beitrag zur Flora Aethiopiens, Berlin, 1867, p. 30. Boissier Flora Orient. vol. II, p. 2.

<sup>2</sup> Guibourt, N. J. Histoire naturelle des drogues simples, Paris. 7. ed. 1876, vol. 3, p. 506.

<sup>3</sup> Josephus Ant. Jud. VIII, VI, 6; IX, 1, 2; XIV, IV, 1.



balm was obtained by making an incision in the plant with a sharp stone, and that it was the general belief that the original root from which these trees had sprung was the gift of the Queen of Sheba to Solomon. The balsam garden of Jericho measured about 12 acres and that of Engaddi a little less. They did not produce more than 25 litres (about  $5\frac{1}{2}$  gallons) annually. After the destruction of Jerusalem the Romans took charge of the gardens and made them more productive than they had been before. They thus became a source of revenue for the fiscus of the empire. Vespasian and Titus caused specimens of the trees to be exhibited on the day of their triumphal entry in Rome. Pompeius had done the same before. It seems that those gardens existed until the time of the Crusades. The balsam tree, however, like the date palm, has long since disappeared from Jericho and Engaddi.

It appears that even in patriarchal times balm was exported from Gilead to Egypt. At a later period, it is said to have been cultivated, but whether the plants were imported from Palestine or from Arabia has not been ascertained as yet. It was grown especially at Heliopolis, the ancient On. It was also well known that the balsam tree was cultivated from the end of the 11th down to the 16th or 17th century in the vicinity of Cairo, in a place called Matarich or Aïn-Shems. The plantation was surrounded by a wall and guarded by watchmen. When Belon<sup>1</sup> visited Egypt in 1550 he found only some nine or ten plants left which were in a very poor condition, in spite of the fact that fresh material had several times been imported from Mecca. The last specimen was destroyed in 1615 in an inundation of the Nile.

The balsam tree is alluded to by Pliny<sup>2</sup> and Diodorus, and by the botanists Theophrastus and Dioscorides. The Greeks<sup>3</sup> called the plant 'balsamon' and its products were known as 'opobalsamon', the balm proper, 'xylobalsamon', the wood of the balsam tree, and 'karpobalsamon', the fruit. To the Romans the balm was known under the name of 'balsamum'.<sup>4</sup>

<sup>1</sup> Belon, P. Les observations de plusieurs singularités et choses mémorables trouvées en Grèce, Asie, Judée, Egypte, Arabie. Paris, 1598. Ch. XXXIX, p. 246.

<sup>2</sup> Plinius. Historia Naturalis XII, LIV, 1—8.

Cf. Strabon XVI, II, 41; XVII, I, 15.

<sup>3</sup> Geoffroy, E. F. Tractatus de materia medica, De Veget. Paris, 1741, Vol. II, p. 477.

<sup>4</sup> For good illustrations of this tree we refer to the following books:—

Nees von Esenbeck, Weihe et Funk. Plantæ medicinales, oder Sammlung officieller Pflanzen. Düsseldorf, 1828—1833, pl. 354.

Woodville, W. and Hooker, J. W. Medical Botany. London, 1832, vol. 3, pl. 214.

Many interesting details regarding the history and uses of the balm tree are contained in the writers of the 17th and 18th century. We mentioned only a few:

Aipinus, De Balsamo dialogus. Venice, 1591.

Alexander the Great is said to have recognized the value of the precious gum.

## 2. *Boswellia* Roxb.

Trees usually with papery bark. Leaves alternate, crowded at the ends of the branches, deciduous, imparipinnate; leaflets opposite, usually serrate.

Flowers hermaphrodite, small, white, in axillary racemes or panicles. Calyx small, 5-toothed, persistent. Petals 5, narrowed at the base, imbricate. Disk annular, crenate. Stamens 10, alternately long and short, inserted at the base of the disk. Ovary sessile, 3-celled; ovules 2 in each cell, pendulous; style short; stigma 3-lobed.

Drupe trigonous, 3-valved, valves separating from the pyrenes; pyrenes bony, 1-seeded, finally separating from the trigonous axis. Seeds compressed, pendulous; cotyledons contortuplicate, multifid; radicle superior.

*Species* about 10.

*Distribution* :—Tropical Africa, Arabia, India.

**1. *Boswellia Carterii*** Birdwood in Trans. Linn. Soc. XXVII, 143; Engler in Engl. & Prantl Pflanzenfam. III, 4, p. 246.

*English name* :—Frankincense-tree, Olibanum tree.

*Arabic name* :—Maghrayt d'sheehaz (Carter).

*Description* :—A small tree; branchlets terminal, pubescent or tomentose. Leaves 7-10-jugate, sometimes 5-jugate; petiole pubescent; leaflets ovate-oblong, undulate or crenate-undulate, broadly rotundate or truncate at the base, all pubescent or sometimes glabrous on the upper side and velvety and paler on the lower.

Racemes simple, fasciculate, shorter than the leaves. Corolla patent; petals white or wax-coloured; disc rose-coloured; stamens inserted into

Pona. Del vero Balsamo di-gli antichi. Venice, 1623.

Campi. Parere sopra il Balsamo. Lucca, 1639.

Campi. Riposta ad obgettioni. Lucca, 1640.

Campi. In dilucidazione e confirmazione. Pisa, 1641.

Castelli, P. Opobalsamum examinatum. Venice, 1640.

Castelli, P. Opobalsamum triumphans. Venice, 1640.

Baldus. Opobalsami orientalis propugnationes. Rome, 1640.

Vesling. Opobalsami veteribus cogniti vindiciæ. Padua, 1644.

Slevogt. Balsamum verum vulgo Opobalsamum et De Opobalsamo. Jena, 1705—1717.

Vater. Balsami de Mecca natura et usus. Wittenberg, 1720.

Winniken. Beschreibung des wahren Opobalsambaumes. Kopenhagen, 1745.

Stackhouse, J. Extracts from Bruce's Travels in Abyssinia and other modern authorities respecting the Balsam and Myrrh Trees. Bath, 1815.

the side of the disk (in the Arabian variety). Ovary closely appressed to the fleshy disk and half-immersed.

*Flowers*:—June (Dr. G. Birdwood in 1867).

*Locality*:—Near the tanks (Playfair, G. Birdwood, Collins); probably not wild in Aden.

“Dr. Trimen, F.L.S., exhibited specimens of the Olibanum, or Frankincense-tree, *Boswellia Carterii*, Birdwood, gathered by Mr. James Collins at Aden in October 1877.” Proc. Linn. Soc. (Nov. 1877), p. XXIV.

*Distribution*:—Somaliland, Hadramaut.

*Note*:—G. Birdwood’s account of how he came to know and describe *Boswellia Carterii* might be of interest to Europeans residing at Aden:

“When I was placed,” he says, “in charge of the Agri-Horticultural Society’s ‘Old Gardens’ in Bombay, in 1859, I found the tree which Carter had brought from Arabia<sup>1</sup> growing there and labelled, by Stocks, *Boswellia papyrifera*; and in my catalogue of the Government Central Museum, published in 1862, I adopted *Boswellia papyrifera*, Richard, which Royle had called *Boswellia floribunda*, as the source of olibanum; for I had ascertained that *Boswellia thurifera*, Colebrooke, produced none of the olibanum of commerce, but only an oleo-resinous exudation. But I had not seen Endlicher’s and Richard’s descriptions and figures, nor probably had Stocks; and I therefore asked Colonel (then Captain) Playfair, at Aden, whether he could procure me any cutting of the African frankincense-tree. Colonel Playfair sent me a large collection of several varieties of dried leaves and of cuttings, accurately labelled with their native names, with samples of the kind of frankincense which they respectively yielded. At my request he subsequently sent duplicates of his dried specimens to Kew. On the cuttings which were sent to me striking and leafing, I found that I had three kinds:—Yegaar, yielding Luban maitee, an undoubtedly new species, and Mohr Add and Mohr Madow, yielding Luban sheheri, the bulk of the olibanum exported from the Soumali country. Judging by the young leaves solely, I should have been inclined to consider Colebrooke’s, Endlicher’s, Richard’s and Carter’s plants, and Roxburgh’s *Boswellia glabra* all only more or less variations of one species, and Yegaar the only second species. Indeed, if I followed my own erring inclination, I should hold so now.

<sup>1</sup> Carter found the tree growing in the limestone formation about Merbat and Ras Fartak.

"Amongst Playfair's dried specimens of Mohr Add and Mohr Madow, were the leaves of a variety of each, which he said yielded an inferior olibanum, called Luban bedowi.

"Carter's plant never flowered with me, nor until last year would Playfair's. But he had planted duplicates of the cuttings he sent to me, in the romantic little gardens laid out by him near the celebrated tanks of Aden. They had not flowered before he left Aden for Zanzibar; but when passing Aden in June 1867, he found that one of the plants had flowered, and he sent its flowers to Kew. When I saw these in July 1867, it was not known to which kind they belonged, as Playfair had not picked any leaves with them. I therefore on my way back to Bombay, in November 1867, visited the gardens, and found from the gardener that it was Mohr Madow that had flowered the previous June. Seeing the plants were leafing too much, I left directions to water them less abundantly than they had been, and to send me any flowers that they produced. On reaching Bombay, I also stopped watering the plants in Victoria Gardens, the Agri-Horticultural Society's new Gardens in Bombay, and early in the monsoon of last year Mohr Add flowered. In September last, I was again at Aden, and then found Yegaar in full bloom." Transact. Linn. Soc. XXVII, 137-138.<sup>1</sup>

*Uses and History* :—It is probable that several species yield the true Frankincense or Olibanum of commerce, but the most important, perhaps is *Boswellia Carterii*. These balsamiferous trees inhabit the south coast of Arabia and the Somali coast of Africa to Cape Guardafui.<sup>2</sup>

There is no doubt that the Hebrew 'lebonah' meant frankincense. The same word with slight dialectical modifications, occurs in the kindred languages: 'lebunta' or 'lebonta' in Aramaic, 'lebunto' in Syriac and 'loban' in Arabic. From the semitic languages the word passed into Greek under the form 'libanos' which was invariably employed in the Septuagint for the translation of the Hebrew 'lebonah,' whilst the Vulgate translated it into 'thus'. The root of the word is 'laban' *i.e.* 'to be white', which indicates that the name was first given to the

<sup>1</sup> Interesting particulars regarding Arabian and African Gums and Resins will be found in the Journal Bombay Br. Roy. As. Soc. Vol. II, 1848 (by Carter); Transact. Bombay Geogr. Soc. Vol. VII, 1846 (by Cruttenden); Journ. Roy. Geogr. Soc. Vol. XLII, 1872 (by Miles).

<sup>2</sup> On the so-called Indian Olibanum Tree (*Boswellia serrata* Roxb. = *B. glabra* Roxb. = *B. thurifera* Colebrooke) *vide* :

Taleef Shereef, translated by Playfair, 1833, p. 146.

Moodeen Sheriff. Mort. Med. Mad. 1891, p. 96—99.

Biscoe. List of Hyderabad Trees, 1895, p. 3.

Kanny Lal Dey. Indigenous Drugs of India, 1896, p. 50.

Watt. Diet. Economic Prod. Ind. I, 511—17.

Watt. Comm. Prod. Ind. 1908, p. 174.

white incense, which is the purest of all.<sup>1</sup> Certain grammarians defended the opinion that 'libanos' signified the tree and 'libanotos' the incense. But the ancient writers, whilst employing 'libanos' for the tree as well as for the gum, used 'libanotos' exclusively to designate the gum.<sup>2</sup>

Frankincense is not mentioned by Homer, and seems not to have become known to the Greeks till a later period, when it was largely employed in the obsequies of the wealthier citizens, as it is in our day with high caste Hindoos.<sup>3</sup>

Though the frankincense was well known to the ancients, they had, nevertheless, very vague and often erroneous notions of the plant which produces the gum.<sup>4</sup> Pliny confesses that little was known regarding the shape of the tree, and that the Greeks had given thereof the most varied descriptions.<sup>5</sup> The information on the method of obtaining the gum is equally unreliable.<sup>6</sup>

According to the ancient authors the frankincense came from Shebah. In Isaiah (LX, 6) it is said: "All they from Sheba shall come; they shall bring gold and frankincense," and in Jeremiah (VI, 20): "To what purpose do you bring me frankincense from Sheba and the sweet-smelling cane from a far country."—Pliny calls the Sabaeans the best known amongst the Arabs on account of the frankincense,<sup>7</sup> and in another place he says that Sheba is the 'thuriferous country.'<sup>8</sup> Similarly Virgilius in his *Georgica*:

"Solis est thurea virga Sabaeis."<sup>9</sup>

Niebuhr and Tristram, not being able to understand how Yemen and Hadramaut could produce a quantity of frankincense sufficient to satisfy the demands of the Old World, were of opinion that the Arabs imported part of the supply from India.<sup>10</sup> They thought to have found an argument in the fact, that the Arabs sometimes call the frankincense 'kondor' or 'kundur', an Indian name given to the aromatic gum of

<sup>1</sup> Cf. Plinius. *Historia Naturalis*. XII, 32; Theophrastus. *Historia Plantarum* IX, 4.

<sup>2</sup> Schleusner, J. F. *Novus thesaurus philologico-criticus*. Leipzig, 1820, vol. 3, p. 453.

<sup>3</sup> Groser, W. H. *The trees and plants mentioned in the Bible*. London, 1895, p. 212.

<sup>4</sup> Theophrastus. l. c.; Diodorus Sic. V, 41.

<sup>5</sup> Plinius. *Historia Naturalis*. XII, 31.

<sup>6</sup> Plinius. l. c. XII, 32—Theophrastus l. c. XI, 14.

<sup>7</sup> Plinius. l. c. VI, 32.

<sup>8</sup> Plinius. l. c. XII, 30. Cf. Strabo XVI, 19.

<sup>9</sup> Virgilius. *Georg.* I, 58.—For other ancient writers who mention Sheba as being the home of frankincense cf. Celsius. *Hierobotanicon*. Amsterdam, 1748, vol. I, p. 240—241.

<sup>10</sup> Niebuhr. *Description de l'Arabie*. Paris, 1779, vol. p. I, 202—203.

Tristram. *The natural history of the Bible*. London, 1889 p. 355.

the plant which was described by Colebrooke as *Boswellia thurifera*<sup>1</sup> (= *B. serrata* Roxb.). It must not be forgotten, however, that Arabian and African frankincense has long been regularly imported to India. It bears various names : kundur, luban, thus, visesh, esesh, parangi-shambirani, kunurakkam-pishin, etc. Muhammedan writers distinguish several varieties of the olibanum imported into India : 'kundur zakar', male frankincense which is the best quality and consists of deep yellow tears; 'kundur unsa', female frankincense; 'kundur madharaj' the exudation artificially made into tears;<sup>1</sup> 'kishar kundur' or 'kashfa', the 'dhup' of the Bombay market, consisting of the bark of the tree coated with the exudation, and 'dukak kundur', the dust of the olibanum and substance reserved for the Indian and Chinese market, whilst the finer qualities are assorted and exported from Bombay to Europe.<sup>2</sup> The 'kundur' is and was thus an article imported and subsequently re-exported. In Hindoo books the frankincense is always mentioned as a foreign production, and to this day the people in the bazaars of Western India tell you that it comes from Arabia. It is besides, very probable that nearly all that has been written about the medicinal properties of the Indian Olibanum Tree (*B. serrata*) refers to the imported olibanum. The Indian product is only slightly aromatic and, being consumed almost entirely in Central and Western India, is hardly if at all exported.

If the merchants of Arabia Felix were in need of greater supplies, they had only to cross the Red Sea, in order to find the aromatic product of several species of Frankincense-Trees. There is *Boswellia papyrifera* in Sennaar and Abyssina,<sup>3</sup> *Boswellia frereana* in Somaliland, which produces, besides, several varieties of *Boswellia carterii*.<sup>4</sup>

It is from these countries that the ancient Egyptians obtained their 'anti' (frankincense). Under the reign of Queen Hatespu a fleet of five ships was sent out to gather the treasures of that region. The successful expedition was represented afterwards on the walls of the temple of Deir-el-Bahari. The artist shows the transport and loading of the frankincense-trees. Thirty-one trees were dug out, put into baskets and brought to the ship.<sup>5</sup>

<sup>1</sup> Colebrooke. On Olibanum or Frankincense. Asiatic Res. Calcutta, vol. 9, p. 377.

Cf. Roxburg. Fl. Ind. Serampore, 1832, II, 388.

<sup>2</sup> Watt. Commenc. Prod. of Ind. London, 1908, p. 174.

<sup>3</sup> A. Richard. Tentamen floræ abyssinicae. Paris, 1851, vol. I, p. 148.

<sup>4</sup> Joret, C. Les plantes dans l'antiquité. Paris, 1897, vol. I, p. 356, 499.

<sup>5</sup> Naville, M. Egypt Exploration Fund, archæological report, 1894-95, p. 36-37.

Dümichen. Die Flotte einer ägyptischen Königin. pl. 3.

Maspero, G. Histoire ancienne des peuples de l'Orient. 1897, vol. 2, p. 247-253.

Loret, V. La flore pharaonique. 2nd ed. 1892, p. 96.

Some authors were of opinion that the frankincense-tree was also imported and cultivated in Palestine. They were misled by the words of the Canticles (IV, 6), "Till the day break, and the shadows retire, I will go to the mountain of myrrh, and to the hill of frankincense." But there is no reason why we should take these words verbatim and not rather consider them as poetical comparisons describing a delicious place filled with sweet and balmy perfumes.<sup>1</sup>

Pliny says that the kings of Asia planted frankincense-trees at Sardes<sup>2</sup>. It is, however, not very probable that the tree in question was a species of *Boswellia*, introduced either from Arabia, India, or Africa. There is a certain confusion in Pliny's description of this tree and it is, therefore, quite possible that the plantation at Sardes consisted of *Juniperus phanicea* or *thurifera*. The gum of these trees, after a certain preparation, often went under the name of frankincense.

## XV.—RHAMNACEÆ.

Trees or shrubs, erect or climbing, often armed with spinescent branches or stipular spines. Leaves simple, alternate, rarely opposite, usually coriaceous; stipules small or 0.

Flowers hermaphrodite or polygamous, green or yellow, small, usually axillary, solitary or variously fascicled. Inflorescence generally cymose. Sepals 4—5; lobes shortly triangular, erect or recurved, usually keeled within, valvate in bud. Petals 4—5, rarely 0, inserted at the mouth of the calyx-tube, or on the edge of the disk. Stamens 4—5, opposite to and inserted with the petals, often enclosed within their folds; anthers versatile, 2-celled. Disk fleshy and filling the calyx-tube, or thin and lining it, entire or lobed. Ovary sessile, free or immersed in the disk, wholly free from, or more or less adnate to the calyx-tube, 3-, rarely 2—4-celled; ovule 1, rarely 2 in each cell, erect, anatropous; style erect, short, usually 2—4-fid.

Fruit a drupe, or capsule, 1—4-celled. Seeds with fleshy albumen, rarely exalbuminous; embryo large, straight; cotyledons flat, fleshy; radicle inferior.

*Genera* 37; *species* about 420.

*Distribution*:—Temperate and tropical regions of the whole world.

### 1. *Zizyphus* Juss.

Shrubs or trees. Medullary rays numerous, very fine. Generally armed with stipular spines, which as a rule are unequal, one straight, the other

<sup>1</sup> Celsius, l. c. p. 242-243.

<sup>2</sup> Plinius, l. c. XII, 31.—Cf. Theophrastus, l. c. IX, 4.

curved. Leaves alternate, more or less distichous, with 3, rarely 4 or 5, basal nerves.

Flowers small, pentamerous, mostly bisexual, generally in axillary cymes. Calyx cup-shaped or broad-obconical, lobes keeled inside, petals sometimes wanting, disk lining the calyx-tube, edge free, pentagonous or 5-10-lobed. Ovary immersed in disk, and more or less confluent with it, 2-celled, rarely 3-or 4-celled; styles 2-3, free or partly connate.

Drupe as a rule fleshy; stone rugose or tuberculate, 1-3-celled, 1 seed in each cell; embryo in thin albumen, cotyledons thick, flat or convex, radicle short, inferior.

*Species* about 40.

*Distribution*:—Most species are Indo-Malayan, a few in Africa, America and Australia.

Leaves 1—3 inches long, crenate-serrate	.	.	.	1. <i>Z. spina</i> Christ.
Leaves $\frac{1}{2}$ —1 $\frac{1}{2}$ inches long, obsoletely crenate	.	.	.	2. <i>Z. lotus</i> .

**1. *Zizyphus spina* Christi** (Forsk.) Willd. Sp. Pl. I, 1105; DC. Prodr. II, 20; Boiss. Fl. Or. II, 13; Batt. et Trab. Fl. d'Alg. p. 189; Oliv. Fl. trop. Afr. I, 380.

*Rhamnus spina* Christ L. Sp. Pl. 282.

*Rhamnus nabeca* Forsk. Fl. Aeg.-Arab. p. 204.

*Zizyphus africana* Mill. n. 4.

*Zizyphus napeca* Lam. Dict. III, 320 (non Roxb.).

*Zizyphus jujuba* Desf. Bull. Soc. Bot. France XXXII.

*Arabic name*:—Elb, elan, ssidr, arg.

*Description*:—A tree or shrub with white long flexuose or short imbricate branches. Leaves ovate, ovate-oblong or lanceolate, obtuse or acute, often mucronate, equal at the base, crenate-serrate, 1—3 inches long, glabrous or slightly pubescent beneath when young especially along the veins; petioles  $\frac{1}{2}$ —1 inch long; stipular spines when present short, both or 1 only recurved.

Cymes pubescent, few- or many-flowered, sessile or on peduncles from a line to an inch or more in length. Flowers large for the genus. Calyx densely pubescent. Disk large, furnished with a fringe of hairs around the base of the styles. Styles united above the middle and then spreading, not recurved.

Drupe 2-celled, large, fleshy, spherical.

*Locality*:—Plain of Maala (Schweinf.); ravine west of the Tower of Silence, crater of the Shum Shum Range (Desf.); without locality (Balfour).

*Distribution*:—Senegambia, Niger, Algeria, Egypt, Libya, Nubia, Abyssinia, S. Arabia, Socotra.



*Uses*.—"Notwithstanding the hardness and length of the spines, which grow on its branches, intermingled with its leaves, the camels, from the cartilaginous formation of their mouths, feed on both with much avidity, and without to appearance suffering any inconvenience. The fruit, of which they are equally fond, clusters in great abundance amidst its branches, and from its golden colour gives to the tree a rich and pleasing appearance; the natives assert that it is produced at all seasons; it resembles a cherry in form and size, and has a peculiar though mild and pleasant flavour. The Arabs pound them between two stones into a paste-like consistence, which they mix with ghee, and swallow with much apparent relish." (Wellsted in Journ. Roy. Geogr. Soc. V. (1835 151.)

See also : Ibn-el-Beithar, II, p. 238—239.

**2. Zizyphus lotus** Lam. Dict. III, 316; Anders. Journ. Linn. Soc. V, Suppl. p. 13; Batt. et Trab. Fl. d'Alg. II, 188.

*Rhamnus lotus* L. Sp. 281.

*Description*.—Small trees; branches zigzag, slender, spinose; bark whitish. Leaves 6 lines—1½ inches long, 4 lines—1 inch broad, ovate, three-nerved, obsoletely crenate, softly tomentose on the lower side; petiole 6 lines long; stipular spines unequal, the shorter one recurved, the longer one straight and longer than the petiole.

Flowers inconspicuous, 2 together in the axils of leaves; peduncle much shorter than the petiole, deflexed. Ovary bilocular; styles two.

Drupe solitary, subglobose, the size of a cherry.

*Fruits*.—Dec. 1889 (Defl.).

*Locality*.—Aden (Hook., Birdw., Defl.).

*Distribution*.—Both shores of the Mediterranean, Palestine, Hadramaut.

## XVI.—VITACEÆ.

Sarmentose or suberect shrubs with usually a copious watery juice; stems and branches nodose. Leaves alternate, rarely opposite, simple or digitately or pedately 3—11-foliate, rarely pinnate.

Flowers regular, hermaphrodite, rarely unisexual, in cymes, racemes, panicles or thyrsi, usually opposite the leaves, peduncles often transformed into simple or compound tendrils. Calyx small, entire or 4—5-dentate or-lobed. Petals 4—5, free or variously cohering, valvate. Stamens 4—5, opposite to the petals, inserted outside and often between the lobes of a hypogynous disk; filaments subulate; anthers free or connate, 2-celled, introrse. Ovary usually sunk in the disk, 2—6-celled; ovules 2, rarely 1, in each cell, ascending, anatropous; raphe ventral;

style simple, conical, subulate, or absent; stigma capitate or discoid, sublobate.

Fruit a berry, often watery; cells 1—2-seeded. Seeds rugulose, with a stony or crustaceous testa; embryo small, in a copious generally hard albumen; radicle inferior.

*Genera 3, species about 500.*

*Distribution* :—Tropical and temperate regions of the world.

### 1. *Vitis* Linn.

Shrubs with herbaceous, woody or succulent stems, usually sarmentose with copious tendrils, sometimes suberect. Leaves simple or compound.

Flowers umbellate, cymose, paniculate, racemose or spicate; peduncles leaf-opposed, rarely axillary, usually towards the ends of the branches. Calyx entire or 4—5-dentate or-lobed. Petals 4—5, free or calyptrately cohering at the apex. Disk various or obsolete. Stamens 4—5, inserted below the margin of the disk; anthers free. Ovary 2-celled, rarely 3—4-celled; ovules 2 in each cell.

Berry 1—2-celled; cells 1—2-seeded.

*Species about 400.*

*Distribution* :—Cosmopolitan.

*1. Vitis quadrangularis* Wall. Cat. 5992; W. & A. Prodr. 125; Wight Ic. t. 51; Brand. For. Fl. 100; Hook. Fl. Brit. Ind. I, 645; Oliver Fl. trop. Afr. I, 399; Cooke Fl. Bomb. Pres. I, 250.

*Cissus edulis* Dalz. in Hook. Lond. Journ. Bot. IX, 248; Dalz. and Gibs. Bomb. Fl. 40; Thw. Enum. 62.

*Cissus quadrangularis* Linn. Mant. 39; Roxb. Fl. Ind. I, 407; DC. Prodr. I, 628; Grah Cat. Bomb. Pl. 33; Dalz. and Gibs. Bomb. Fl. 39.

*Sælanthus quadragonus* Forsk. Descr. 33, t. 2.

*Cissus tetraptera* Hook. f. Fl. Nigrit. 263.

*Cissus triandra*

*Cissus bifida*

} Schum. et Thonn. Guin. Pl. 81.

*Arabic name* :—Ssela.

*Description* :—Stem thick, wide-climbing, herbaceous, quadrangular, constricted at the nodes, the angles of the young branches winged; tendrils long, slender, simple. Leaves 1—2 inches long, broadly ovate or reniform, sometimes 3—7-lobed, denticulate, glabrous, cordate, rounded, truncate or cuneate at the base; petioles  $\frac{1}{4}$ — $\frac{1}{2}$  inch long; stipules small, broadly ovate, obtuse.

Flowers in shortly peduncled cymes, with spreading umbellate branches. Calyx cup-shaped, truncate, or obscurely lobed. Petals 4, ovate-oblong, hooded at the apex. Disk erect, 4-lobed.

Berry scarcely  $\frac{1}{4}$  inch long, apiculate, red when ripe, 1-(rarely 2-) seeded.

*Locality*.—Aden (Birdwood, Lunt).

*Distribution*.—Senegambia, Nubia, Abyssinia, Angola, Zambesi-land, Arabia, throughout India, Ceylon, Java, Malay Archipelago.

## XVII.—MORINGACEÆ.

Soft-wooded deciduous trees. Leaves alternate, impari-bi-or tripinnate, clustered at the end of the branches; pinnæ and leaflets opposite; leaflets quite entire, obovate, caducous, and as well as the pinnæ and pinnules, with glands at the base; no stipules.

Flowers large, hermaphrodite, irregular, in axillary panicles. Calyx 5-cleft, with a short, cup-shaped tube and unequal, imbricate, at length spreading or reflexed segments. Petals 5, upper smaller. Disk lining the calyx-tube. Stamens inserted on the free edge of disk, 5 perfect, opposite to petals, alternating with 5, sometimes 7 or 10, filaments without anthers; anthers dorsifixed, oblong, 1-celled. Ovary 1-celled, stipitate; style terminal, slender; ovules indefinite, anatropous, pendulous, biseriate, on 3 parietal placentas.

Capsule beaked, 3—6-angled, 1-celled, loculicidally 3-valved. Seeds numerous; albumen 0; testa corky, winged or not; embryo straight; cotyledons plano-convex; radicle very short, superior; plumule many-leaved.

*Genus 1: species 3.*

*Distribution*.—W. Asia and N. Africa.

### 1. *Moringa* Lam.

Character of the order.

1. *Moringa aptera* (Forsk.) Gaertn. Fructus II, 315; Anders. Journ. Linn. Soc. V, Suppl. p. 14; Boiss. Fl. Or. II, 22.

*Moringa arabica* Pers. Syn. I, 460.

*Balanus myrepsica* Belon Obs. p. 126.

*Hyperanthera* Forsk. Fl. Aeg.—Arab. p. 67.

*Description*.—A small tree, 10—12 feet high, bark cinereo-fuscescent; branches divaricate; younger branches green. Rhachis 2—3-pinnate, 4—8-jugate, deflexed; leaflets ovate, obtuse, entire.

Panicles erect, axillary. Flowers herbaceous, glaucous, pedicellate; pedicels bracteolate, articulate. Calyx 5-partite; segments imbricate, subequal, oblong. Petals oblong-linear, reflexed, pale yellow, usually with carmine-red nervation. Stamens 10, unequal; filaments yellow; anthers unilocular.

Ovary free, stipitate, 3-sulcate.

Capsule obscurely trigonous, 3-valved, with the valves longitudinally bisulcate, 3-fastigiate, 8 inches to 1 foot long, deflexed. Seeds turbinate, trigonous, pendulous; testa crustaceous.

*Flowers*:—January 1880 (Balfour), March 1875 (Hildebr.), March 1878 (Perry), Dec. 1889 (Defl.).

*Locality*:—In rocky valleys near Steamer Point (Anders.); Steamer Point (Defl.); Goldmore Valley (Schweinf., Defl.); without locality (Balfour, Perry, Birdw., Marchesetti, Kuntze).

*Distribution*:—Upper Egypt, Abyssinia, Nubia, Eritrea, Kordofan, Sennaar, South Arabia, Syria.

*Uses*:—From the seeds a clear, limpid, almost colourless oil is easily extracted by pressure. Ben or Ban is the Arabic name for the oil. Commercially it is termed Ben Oil, and is highly valued as lubricant by watch-makers.

### XVIII.—LEGUMINOSÆ.

Herbs, shrubs or trees. Leaves alternate with few exceptions, usually stipulate, compound; leaflets sometimes stipellate.

Inflorescence various. Calyx gamosepalous, 5-dentate or lobed, or 2 or more teeth connate, rarely polysepalous. Corolla of 5, rarely fewer petals, usually irregular and imbricate in sub-orders 1 and 2, regular and valvate in 3. Stamens usually 10 or indefinite, perigynous or subhypogynous; anthers 2-celled. Pistil 1-carpellary; ovary free with 1 or more ovules on the ventral suture; style simple.

Fruit a legume dehiscing by both sutures, more rarely follicular or indehiscent. Seeds usually exalbuminous; cotyledons foliaceous or amygdaloid with a straight or inflexed accumbent radicle.

*Genera* about 400; *species* between 6,000—7,000.

*Distribution*:—Throughout the globe.

#### *Sub-order 1. Papilionaceæ.*

Herbs, shrubs or trees, sometimes scandent. Leaves alternate, digitate or pinnate, rarely 1-foliate or simple.

Flowers irregular. Calyx gamosepalous, 5-toothed or lobed, or 2 upper lobes more or less connate, or bilabiate, rarely closed in bud and spathaceous. Corolla papilionaceous; petals 5, free or adnate to the staminal tube, the posterior (standard) outside in bud, the 2 lateral (wings) intermediate, the 2 lower inside and usually cohering by their lower margins

(keel). Stamens 10, diadelphous, monadelphous or free. Ovary free; embryo usually with an inflexed radicle. Cotyledons accumbent.

*Distribution*:—All over the world.

*Tribe 1. Genisteæ*:—Stamens 10, monadelphous or diadelphous. Anthers usually of 2 kinds. Pod 2-valved, not articulated. Leaves simple or digitately trifoliate—

- |  |                          |
|--|--------------------------|
| Tube of stamens slit along the top . . . . .     | 1. <i>Crotalaria</i> .   |
| Tube of stamens not slit along the top . . . . . | 2. <i>Argyrolobium</i> . |

*Tribe 2. Trifolieæ*:—Stamens diadelphous; filaments usually dilated at the apex. Pod usually dehiscent, not jointed.

- |                                      |                      |
|--------------------------------------|----------------------|
| Leaves pinnately 3-foliate . . . . . | 3. <i>Medicago</i> . |
|--------------------------------------|----------------------|

*Tribe 3. Galegeæ*:—Stamens monadelphous or diadelphous; anthers usually uniform. Pods usually 2-valved, not articulated. Leaves imparipinnate, rarely simple entire—

- |   |                        |
|---|------------------------|
| a. Anthers apiculate. Hairs fixed by the centre . . . . . | 4. <i>Indigofera</i> . |
| b. Anthers obtuse. Hairs basifixed.                       |                        |
| *Flowers mostly in leaf opposed racemes . . . . .         | 5. <i>Tephrosia</i> .  |
| **Flowers mostly in axillary racemes . . . . .            | 6. <i>Sesbania</i> .   |

*Tribe 4. Hedysareæ*:—Stamens monadelphous or diadelphous, anthers dimorphous or uniform. Pods usually articulated. Leaves imparipinnate, rarely abruptly pinnate.

- |                          |                        |
|--------------------------|------------------------|
| Not spinescent . . . . . | 7. <i>Taverniera</i> . |
| Spinescent . . . . .     | 8. <i>Alhagi</i> .     |

*Tribe 5. Phaseoleæ*:—Stamens diadelphous or monadelphous. Anthers usually uniform. Pod 2-valved, not articulated. Scandent, rarely erect herbs.

- |                                      |                        |
|--------------------------------------|------------------------|
| Leaves pinnately 3-foliate . . . . . | 9. <i>Rhynchosia</i> . |
|--------------------------------------|------------------------|

## 1. *Crotalaria* Linn.

Herbs or shrubs with simple or digitately trifoliate leaves. Flowers in racemes, terminal or leaf-opposed or rarely in the axils of the leaves. Calyx-tube short, of 5 distinct equal or subequal teeth. Petals subequal; standard orbicular or ovate with a short claw; keel rostrate, upcurved. Stamens monadelphous (diadelphous in *C. Schweinfurthii* Defl.); anthers dimorphous. Ovary sessile or stalked, bi- or many-ovulate; style abruptly bent upwards near the base, bearded along the inner side.

Pod straight, linear-oblong, turgid or inflated (not inflated in *C. leptocarpa* Balf.), continuous within.

*Species* over 350.

*Distribution* :—Tropical and subtropical regions.

Stamens monadelphous.

Pod inflated—

Pod 8-10 lines long, silky . . . . .	1. <i>C. lupinoides</i> .
Pod 1½—2 inches long, glabrous . . . . .	4. <i>C. striata</i> .
Pod 1—1½ inches long . . . . .	5. <i>C. falcata</i> . <sup>1</sup>
Pod not inflated . . . . .	2. <i>C. leptocarpa</i> .
Stamens diadelphous . . . . .	3. <i>C. Schweinfurthii</i> .

**1. *Crotalaria lupinoides*** Hochst. in Herb. Kotschy Pl. Nub. n. 41; Benth. Lond. Journ. Bot. II, 583.

*Description* :—Suffruticose; branches spreading, curved, upper part thinly silky. No stipules. Petioles about 1 inch long, glabrous. Leaflets 3, subsessile, oblong-obovate, central one 1—1½ by ½—¾ inch, upper surface glabrous, the lower thinly silky.

Flowers in elongate many-flowered, lax, stalked, terminal and lateral racemes, the main ones ultimately 8—12 inches long. Bracts very small, setaceous. Pedicels silky, cernuous, ½ inch long. Calyx slightly silky, 2—3 lines deep, teeth lanceolate, reaching about half way down. Corolla bright yellow, ½ inch deep.

Pod short-stalked, cylindrical, much curved upwards, 8—10 lines long, under ¼ inch thick, silky on the outside, filled within with fine silky hairs.

The seeds usually remain undeveloped. Schweinfurth found ripe seeds only in one case, *viz.*, on specimens which he collected on the left side of the Nile at Dar Matamma (Nubia). The seeds were 3.5 mm. long and 2.5—3 mm. broad, oval to triangular, shining, not smooth, leather-yellow.

*Flowers and fruits* :—December and March (Schweinf.).

*Locality* :—Wadi Maala (Schweinf.), ravine south-west of the Tower of Silence (Defl.), on the way from Aden to the Shum Shum Range at a height of about 500 feet (Busse); without locality (Birdw.).

*Distribution* :—Upper Egypt, Nubia, Eritrea, Kordofan, Yemen.

**2. *Crotalaria leptocarpa*** Balf. f. Proceed. Roy. Soc. Edinb. XXXI, 66, tab. XIV, A.

*Crotalaria dubia* Balf. f. Proceed. Roy. Soc. Edinb. XI, 508 (non Graham).

*Description* :—A low herb, stem woody, short, subterraneous; branches subfiliform, numerous, with long internodes, wide-patent, often 1½ feet long, decumbent. Leaves palmately trifoliate, petiolate, villous at the

<sup>1</sup> *C. falcata* is distinguished from *C. striata* by being more shrubby, having shorter petioles, smaller flowers, and broader leaflets.

base ; petiole  $\frac{1}{4}$ — $\frac{1}{2}$  inch long ; leaflets usually linear-lanceolate, acuminate,  $\frac{1}{2}$ — $1\frac{1}{2}$  inches long, but varying to obovate mucronate and only  $\frac{1}{5}$  inch long and  $\frac{1}{8}$  inch broad, all sessile or subsessile, strigose, the central one longer ; stipules minute, subulate. Racemes elongate, terminal, few-flowered, with internodes measuring  $\frac{3}{4}$ —1 inch ; bracteoles very minute ; pedicels capillary,  $\frac{1}{6}$  inch long. Calyx  $\frac{1}{8}$  inch long, externally clothed with appressed, short, pilose hairs ; segments narrow, acuminate,  $\frac{1}{8}$  inch long, the upper one broader. Corolla yellow, long-exserted ; vexillum suborbicular, mucronate,  $\frac{3}{10}$  inch long ; keel ciliate on the lower margin. Filaments alternately dilate above and united into a tube. Ovary stipitate ; style incurved,  $\frac{1}{8}$  inch long ; stigma more or less distinctly bilobed, each lobe being flattened.

Pod shortly stipitate, obliquely oblong, compressed, membranous, venulose, pubescent, not inflated. Seeds 12 (in Balfour's specimens).

*Flowers and fruits* :—March (Schweinf.).

*Locality* :—Plain of Maala, together with other small herbs between shrubs of *Acacia* on rocky hills (Schweinf.) ; Koosaf Valley, ravine of the Jebel Ihsan on Little Aden (Defl.) ; without locality (Birdw.).

*Distribution* :—Socotra, Somali-coast at Bulkar.

*Note* :—"This plant, which in its general habit and structure is thoroughly Crotalarioid, differs so decidedly from the type of the genus that it is with difficulty one can include it as a species. The fruit is not at all inflated or tumid, and the valves are quite thin and membranous with beautiful veining. In addition, there is a divergent character in the stigma, which [in the Socotran plant] is distinctly two-lobed, each lobe being flattened and pointed. But if we exclude the plant from this genus, I can find no other in which to place it, and the characters are perhaps hardly sufficient to warrant at present the creation of a new genus" Balfour, Botany of Socotra, p. 67.

### 3. *Crotalaria Schweinfurthii* Defl. Bull. Soc. Bot. France XXXII, 348.

*Description* :—A low shrubby plant,  $1\frac{1}{2}$  feet high or less, silky all over, much branching from the base ; branches erect, unarmed. Leaves few, sessile, exstipulate, digitately trifoliate ; leaflets small, 3—4 lines long,  $\frac{1}{2}$  line broad, all of the same size, obovate-cuneate.

Flowers sessile, solitary. Calyx canescent ; teeth linear-lanceolate, 2 lines long, 3—4 times as long as the tube. Corolla white ; vexillum  $1\frac{1}{4}$  lines long, undulate ; keel purpurascens at the apex ; restrum falcate. Stamens diadelphous (!). Ovary 2—3-ovulate, glabrous ; style glabrous, geniculate at the base.

Pod ovoid, 2 lines long,  $\frac{3}{4}$  line broad, shortly stipitate, slightly shorter than the calyx. Seeds exarillate, subglobose, smooth.

This species is nearly allied to *C. microphylla* Vahl, but differs from it by the leaves being sessile, by the falcate rostrum and by the few-ovulate ovary.

*Flowers* :—From March to April (Defl.).

*Locality* :—Goldmore Valley, Crater of the Shum Shum Range on débris at the entrance of the Koosaf Valley (Defl.). Rare.

Endemic in Aden.

**4. *Crotalaria striata*** DC. Prodr. II (1825) p. 131; Bot. Magaz. t. 3200; Hook. Fl. Brit. Ind. II, 84; Oliver Fl. trop. Afr. II, 38; Harvey and Sonder Fl. Cap. II, 44; Trim. Fl. Ceyl. II, 18; Cooke Fl. Bomb. Pres. I, 303.

*Crotalaria Brownei* Reich. Icon. Exot. t. 232; DC. Prod. II, 130.

*Crotalaria Hookeri* Arn. in Ann. Sc. Nat. ser. 2, III, 248.

*Crotalaria pisiformis* Guill. & Per. Fl. Seneg. 162.

*Crotalaria fertilis* Delile in Ferr. & Gall. Voy. Abyss. 122, t. 11.

*Crotalaria latifolia* Hort. Calc.

*Crotalaria pallida* Klotzsch in Peters. Mossamb. Bot. 57.

*Description* :—Herbaceous or suffruticose, erect, divaricately branched; branches angular and striate, thinly canescent, the very young ones silky; stipules minute, deciduous or none. Leaves membranous; petioles  $1\frac{1}{2}$ —3 inches long, stout, slightly pubescent. Leaflets 2—3 by 1— $1\frac{1}{2}$  inches, elliptic, obtuse or acute, sometimes emarginate, glabrous above, minutely puberulous and glaucous beneath.

Flowers numerous, in erect terminal and lateral elongate spicate 20-50 flowered racemes which sometimes reach 1 foot long; pedicels very short; bracts setaceous, minute. Calyx  $\frac{1}{4}$  inch long, slightly pubescent outside; teeth as long as the tube, lanceolate. Corolla dull yellow, veined with purple, twice as long as the calyx.

Pods  $1\frac{1}{2}$ —2 inches long, much deflexed, oblong, cylindric, glabrous; shortly stalked. Seeds 20—30, dark brown.

*Locality* :—Aden (Perry, Lunt).

*Distribution* :—Throughout the tropics of both hemispheres.

**5. *Crotalaria falcata*** Vahl ex DC. Prodr. II, 132; Benth. in London Journ. Bot. II, 585; Baker in Fl. trop. Afr. II, 40.

*Crotalaria striata* Schum. et Thon. Pl. Guin., non DC.

*Description* :—Stem fruticose, 2—3 feet high, diffusely and divaricately branched, slightly silky upwards. Stipules none. Petioles 1 inch long.



Leaflets 3, obovate, subsessile, central  $1-1\frac{1}{2}$  inches long,  $1\frac{3}{4}-1$  inch broad, apex rounded, mucronate, upper surface glabrous, lower slightly silky in the young plant.

Flowers in long-stalked lax terminal and lateral racemes. Bracts minute. Pedicels 1 line long, silky, erecto-patent. Calyx slightly silky,  $\frac{1}{4}$  inch long, the teeth lanceolate, reaching about halfway down. Corolla yellow, rather more than twice as long as the calyx, keel much upcurved.

Pod sessile, cylindrical,  $1-1\frac{1}{2}$  inches long,  $\frac{3}{4}$  inch thick, very silky when young, 15—20-seeded.

*Locality* :—Aden (Playfair in Herb. Calc. ex nota Kew.).

*Distribution* :—Upper Guinea : Niger country.

## 2. *Argyrolobium* Eckl. et. Zeyh.

Undershrubs or herbs with digitately trifoliate leaves. Stipules free.

Flowers in racemes or umbels. Calyx deeply bilabiate. Corolla scarcely exerted ; standard suborbicular, wings free, keel slightly upcurved, not rostrate. Filaments usually but not invariably united downwards in a closed tube. Ovary sessile, linear,  $\infty$ -ovulate ; style upcurved ; stigma terminal, often oblique.

Pod linear, flattened, faintly torulose.

*Species* about 50.

*Distribution* :—Chiefly S. Africa, but also India, Siberia, Central Europe.

Flowers yellow . . . . .	1. <i>A. arabicum</i> .
Flowers rose-coloured or purplish . . . . .	2. <i>A. roseum</i> .

**1. *Argyrolobium arabicum*** Jaub. et Spach. Ill. Pl. Or. I, 115 ; Anders. Journ. Linn. Soc. V, Suppl. p. 15 ; Boiss. Diag. Pl. Or. ser. I, II, 13.

*Cytisus arabicus* Dene. Ann. Sc. Nat. ser. II, IV, 78.

*Description* :—A diffuse, much-branched, silky-pilose undershrub ; branches slender, terete, hairs adpressed. Leaves trifoliate ; petiole 4—6 lines long ; leaflets 2—6 lines long, usually linear, narrow, often ovate, with the margin revolute.

Flowers pedunculate, shorter than the petioles, two together ; peduncles axillary, bracteolate ; bracteoles small, lanceolate. Calyx silky with adpressed hairs ; segments lanceolate, oblong, acute. Corolla yellow, glabrous, longer than the calyx, 3 lines long ; standard suborbicular, emarginate ; wings cultriform, obtuse ; stamens 10, monadelphous ; style filiform, persistent, glabrous.

Pod  $1\frac{1}{2}$  inches long, 1 line broad, linear, strigose, undulate, rostrate acuminate with the persistent style, surrounded at the base by the persistent calyx. Seeds 6—10, lenticular.

*Flowers* :—March (Schweinf.) ; October (Marchesetti).

*Locality* :—Plain of Maala, on gravelly ground and volcanic débris (Schweinf.) ; Goldmore Valley (Defl.) ; great valley between Steamer Point and town (Marchesetti) ; slope of Shum Shum Range (Ellenbeck, ex Krause).

*Distribution* :—Yemen, Island of Neymen in the Red Sea.

*Note* :—There are some specimens from Aden in Herb. Kew, named *Argyrolobium arabicum* Jaub. et Spach, which cannot belong to this species, the pod being quite different from that of the typical plant of Jaub. et Spach. One was collected by Perry in March 1878 and the other by Beever in November 1884. In the same way we do not think that Hooker's and Thomson's specimens (December 1847 and February 1851) are identical with the type of Jaub. et Spach.

2. *Argyrolobium roseum* Jaub. & Spach, Illustr. I (1842) 116 ; Hook. Fl. Brit. Ind. II, 64 ; Ait. Pb. and Sind Pl. 38 ; Cooke Fl. Bomb. Pres. I, 289.

*Cytisus roseus* Camb. in Jacq. Voy. Bot. IV, 35, t. 40.

*Argyrolobium ornithopodioides* Jaub. & Spach in Ann. Sc. Nat. ser. 2, XIX, 51 ; Illustr. Pl. Or. I, 116.

*Argyrolobium Kotschyi* Boiss. Diagn. VI, 32.

*Description* :—A small diffuse annual ; stems many from the root, reaching 6 inches long, very slender, terete, clothed with short appressed silky hairs. Leaves 3-foliolate ; petioles  $\frac{3}{16}$ — $\frac{3}{8}$  inch long, silky ; stipules minute, triangular, acute, persistent. Leaflets  $\frac{1}{4}$ — $\frac{3}{8}$  by  $\frac{3}{16}$ — $\frac{1}{4}$  inch broadly obovate-cuneate, occasionally retuse (the lateral leaflets more or less oblique), silky on both sides with appressed hairs ; petiolules very short.

Peduncles reaching 1—2 inches long, very slender, 1—4-flowered. Calyx pubescent outside ; upper lip shorter than the lower ; teeth all triangular, acute. Corolla rose-coloured or purplish ; standard longer than the upper lip of the calyx.

Pods  $\frac{1}{2}$ — $\frac{3}{4}$  inch long by  $\frac{3}{4}$  inch broad, silky pubescent. Seeds 10—15.

*Locality* :—Aden (Perry, Lunt).

*Distribution* :—Tropical and subtropical tracts of the north-west of India, ascending from the plains to 7,000 feet in Kumaon, Sind, Baluchistan, Persia, Aden.

### 3. *Medicago* Linn.

Herbs, rarely shrubs. Leaves pinnately 3-foliolate ; stipules adnate to the petiole ; leaflets toothed.

Calyx-tube campanulate; teeth 5, subequal. Corolla free from the staminal tube; standard obovate or oblong, contracted at the base, subsessile; wings oblong; keel shorter than the wings, obtuse. Stamens diadelphous; filaments not dilated at the apex; anthers uniform. Ovary sessile, usually many-ovulate; style subulate, glabrous; stigma oblique. Pod spirally twisted (rarely falcate), reticulately veined, scarcely dehiscent.

*Species* about 40.

*Distribution* :—Europe, W. Asia, N. Africa.

The following species is cultivated at Shaikh Othman :

### 1. *Medicago sativa* Linn.

*English name* :—Lucern.

Perhaps only a variety of *Medicago falcata* Linn. produced by cultivation. The flowers are almost always violet, purple, or blue, and the pod is spirally twisted so as to form 2, or sometimes 3, complete rings or coils.

### 4. *Indigofera* Linn.

Herbs, shrubs or undershrubs of very various habit, more or less clothed with appressed silky hairs. Leaves imparipinnate or simple; stipules usually small, setaceous.

Flowers in axillary racemes or spikes. Calyx minute; teeth subequal or the lowest longest. Corolla usually rosy or purple; standard ovate or orbicular, sessile or clawed; wings oblong, adhering a little to the keel; keel obtuse or acuminate, gibbous or spurred on both sides. Stamens diadelphous; anthers uniform, apiculate. Ovary sessile or nearly so, usually many-ovulate; style glabrous; stigma capitate, often penicillate.

Pod linear or oblong, rarely globose, septate between the seeds.

*Species* about 300.

*Distribution* :—Warmer regions of both hemispheres, abundant Southern and Tropical Africa.

Flowers in lax, 6-12-flowered racemes . . . . .	2. <i>I. parvula</i> .
Flowers in many-flowered racemes—	
Leaflets 3 . . . . .	6 <i>I. leptocarpa</i> .
Leaflets 3-5—	
Pod 6-8-seeded . . . . .	1. <i>I. paucifolia</i> .
Pod 2-4-seeded . . . . .	3. <i>I. semitrijuga</i> .
Pod 4-5-seeded . . . . .	4. <i>I. arabica</i> .
Leaflets usually 3-7 . . . . .	5. <i>I. argentea</i> .
Flowers in dense sessile heads of 12-20 flowers . . . . .	7 <i>I. trigonelloides</i> .

**1. Indigofera paucifolia** (Forsk.) Del. Fl. d' Eg. p. 127, tab. 37, fig. 2; DC. Prodr. II, 224; Boiss. Fl. Or. II, 190; Hook. Fl. Brit. Ind. II, 97; Oliv. Fl. trop. Afr. II, 88.

*Indigofera erythrantha* Hochst. in Schimp. Hb. Abyss. n. 2178.

*Indigofera oblongifolia* Forsk. Fl. Aeg.-Arab. p. 137.

*Indigofera argentea* Roxb. Fl. Brit. Ind. III, 374.

*Indigofera heterophylla* Roxb. mss.

*Arabic name* :—Hassar.

*Description* :—A suberect shrub, 4-8 feet high; branches numerous, stout, woody, argenteo-canescens. Leaves imparipinnate; stipules  $\frac{1}{2}$  inch long, lanceolate, acuminate. Leaflets 3-5, alternate,  $\frac{2}{3}$ -1 by  $\frac{1}{4}$ - $\frac{1}{2}$  inch, oblanceolate or elliptic-oblong, more or less hairy above, hoary with dense white hairs beneath, base acute.

Flowers small, in long spiked 20-50-flowered racemes; pedicels short. Calyx  $\frac{1}{12}$  inch long, silvery outside; teeth as long as the tube, triangular, acute. Corolla red, thrice the calyx.

Pods 6-9 lines long, slightly curved outwards, torulose. Seeds 6-8, oblong, obtusely 4-gonous, truncate at one end.

*Flowers* :—August 1898 (Birdw.).

*Locality* :—Aden (Birdw.); Little Aden in a ravine of Jebel Ihsan (Defl.); near Shaikh Othman (Ellenbeck, Busse).

*Distribution* :—Java, Ceylon, India, Baluchistan, Arabia, Abyssinia, Nubia, Kordofan, Socotra, Senegambia.

var. *carpostigma* Schweinf. Bull. Herb. Boiss. 1896, App. II, 240.

This variety differs from the type by the pods being very much constricted between the seeds; the leaves are 1-2-foliolate. There is no similar form in Arabia, Nubia or Egypt.

*Fruits* :—In November (Schweinf.).

*Locality* :—Plain of Maala (Schweinf.).

**2. Indigofera parvula** Del. in Caill. Voy. 38, t. 3, fig. 1.

*Description* :—Stem 6-9 inches long, suffruticose, trailing, copiously and diffusely branched from the base; the branches slender, firm, terete thinly silky. Stipules large, ovate-acuminate, persistent, slightly adnate to the petiole. Leaflets 3, obovate, mucronate,  $\frac{1}{2}$  inch long, silky.

Flowers in lax clusters of 2-6; peduncles about  $\frac{1}{4}$  inch long. Calyx thinly silky, the lower teeth lanceolate. Corolla twice as long as the calyx.

Pod spreading, linear, mucronate,  $\frac{1}{2}$  inch long, 1 line thick, silky, nearly terete, 5-6-seeded.

*Fruits* :—August 1898 (Birdw.).

*Locality* :—Aden (Birdw.).

*Distribution* :—Abyssinia, Nubia.

**3. Indigofera semitrijuga** Forsk. Fl. Aeg.-Arab. p. 137; DC. Prodr. II, 230; Boiss. Fl. Or. Suppl. p. 172; Hook. Fl. Brit. Ind. II, 98; Oliv. Fl. trop. Afr. II, 93.

*Indigofera Burmannii* Boiss. Fl. Or. II, 189 et Suppl. p. 172.

*Indigofera somalensis* Vatke Oesterr. Bot. Zeitschr. XXVI, 201.

*Description* :—Stem fruticose, 1 foot or more, diffusely branched from the base; the branches erecto-patent, firm, terete, glaucous-silvery. Stipules setaceous. Petioles  $\frac{1}{2}$  inch long. Leaves  $\frac{1}{2}$  inch long and more, usually with 3 pairs of close sessile obovate leaflets; leaflets  $1\frac{1}{2}$ —2 lines long, the terminal one stalked, base cuneate, apex rounded, mucronate, texture firm, both sides silvery.

Racemes short-stalked, lax, of 6-12 flowers. Calyx silky, 1 line deep, lower teeth linear, reaching halfway down, the other shorter. Corolla more than twice the calyx, silvery on the outside.

Pods spreading, linear-mucronate,  $\frac{3}{8}$  inch long, finely silky, 2-4-seeded.

*Fruits* :—December (Schweinf.); August 1898 (Birdw.).

On the south coast of Arabia it flowers in April and fruits in March.

*Locality* :—Wadi Maala (Schweinf.); Goldmore Valley, promontory of Marshag, Little Aden in the plain between Jebel Ihsan and Jebel Muzulghum (Defl.); without locality (Birdw.).

*Distribution* :—Upper Egypt, Nubia, Abyssinia, Kordofan, Senaar, highlands of Somaliland, Eritrea, S. Arabia, Sind.

**4. Indigofera arabica** Jaub. et Spach Ill. Pl. Or. V, 89, tab. 479; Anders. Journ. Linn. Soc. V, Suppl. p. 15.

*Description* :—Stem more or less woody below, diffusely branched from the base; young branches angular, silky. Stipules setaceous. Petioles very short. Leaflets 3-5, obovate or oblanceolate,  $\frac{1}{4}$ — $\frac{3}{4}$  inch long, 2-3 lines broad, lateral ones sessile and close, all often folded with a decurved point, both sides silvery.

Racemes short, close, of 6-10 flowers. Flowers nearly sessile in the axils of the leaves. Calyx campanulate, silvery, teeth subequal, setaceous. Corolla scarlet, nearly twice the calyx, externally silvery.

Pod  $\frac{1}{4}$ — $\frac{3}{8}$  inch long, 1 line broad, linear-oblong, mucronate, slightly silvery, 4-5-seeded.

*Fruits* : Dec. 1847 (Hook.).

*Locality* :—On rocks (Hook.); without locality (Birdw.).

*Distribution* :—Yemen, Hadramaut, White Nile.

*Note*:—Jaub. and Spach describe the plant as being sometimes 1 foot long. It seems, however, that the Aden specimens are stunted and much smaller, not exceeding 5 inches.

**5. *Indigofera argentea* L.** Mant. II, 243 (non Roxb.); DC. Prodr. II, 224; Boiss. Fl. Or. II, 190; Hook. Fl. Brit. Ind. II, 98; Oliv. Fl. trop. Afr. II, 97; A. Terrac. Fl. d' Anfilha p. 23.

*Indigofera glauca* Lam. Encycl. III, 246.

*Indigofera articulata* Gouan Ill. et Observ. p. 49.

*Indigofera cœrulea* Roxb. Fl. Ind. III, 337.

*Indigofera tinctoria* Forsk. Fl. Aeg.-Arab. p. 138.

*Arabic Name*:—Houer.

*Description*:—A copiously branched shrub, 2-3 feet high. Branches deeply sulcate, silky. Leaves 1-2 inches long; petioles  $\frac{1}{4}$ - $\frac{1}{2}$  inch long; stipules minute, subulate. Leaflets 3-7,  $\frac{1}{2}$ -1 by  $\frac{3}{8}$ - $\frac{5}{8}$  inch, obovate, rounded and apiculate at the apex, argenteo-canescens on both sides, turning blackish when dried.

Flowers in short-peduncled or subsessile racemes of 10-20 flowers; pedicels short, slender. Calyx  $\frac{1}{10}$  inch long, silvery-hairy; teeth triangular, acute, rather shorter than the tube. Corolla yellow,  $\frac{1}{6}$  inch long; standard pubescent on the back.

Pods  $\frac{3}{8}$  inch long, thick, turgid, recurved, shortly mucronate, torulose. Seeds 2-4, commonly 3.

*Flowers and fruits* in Yemen in January and February, on the south coast of Arabia in April (Schweinf.).

*Locality*:—Top of the Shum Shum Range (Schweinf.); Goldmore Valley (Defl.); without locality (Birdw.).

*Distribution*:—Egypt, Nubia, Abyssinia, Eritrea, Kordofan, Socotra, S. Arabia, Sind, W. India.

**6. *Indigofera leptocarpa* Hochst. et Steud.** in Schimp. Pl. Arab. n. 731; Balf. Proc. Roy. Soc. Edinb. XI, 510; Bot. of Socotra 74.

*Indigofera tenuisiliqua* Schweinf. Bull. Herb. Boiss 1894, App. II, 241.

*Description*:—A low rigid herb, strigose, canescent, much branched. Branches with long internodes, wide-patent, decumbent, subfastigiata, subcompressed, angular. Leaves  $\frac{1}{4}$ — $\frac{5}{12}$  inch long, trifoliate, petiolate; petiole  $\frac{1}{12}$ — $\frac{1}{9}$  inch long; leaflets all sessile, ovate, or elliptic acute, or obtuse, rigidly strigose. Stipules  $\frac{1}{8}$  inch long.

Racemes about 5 inches long, flowers disposed towards the apex, pedicels  $\frac{1}{12}$  inch long, bracteoles setiform. Calyx  $\frac{1}{9}$  inch long; lobes

acute, the upper one as long as the tube, the others shorter. Corolla small; vexillum  $\frac{1}{8}$  inch long, obovate, unguiculate, slightly longer than the keel. Ovary as long as the stout style.

Pod  $\frac{3}{8}$ — $1\frac{1}{2}$  inches long,  $\frac{1}{12}$  inch broad, linear, strigose, 6—8— $\infty$ -seeded.

*Locality*:—Little Aden, plain between Jebel Ihsan and Jebel Muzulghum (Defl.).

*Distribution*:—Nubia, Eritrea, Central and Southern Arabia, Socotra.

**7. Indigofera trigonelloides** Jaub. et Spach Illustr. V (1857) 92, t. 482; Hook. Fl. Brit. Ind. II, 94; Cooke Fl. Bomb. Pres. I, 312.

*Indigofera asperifolia* Hochst. in Schimp. Pl. Abyss. No. 2272.

*Indigofera æruginis* Schweinf. Fl. Aethiop. 11.

*Description*:—An annual, densely silvery; stems many, caespitose, trailing, much-branched, 6-15 inches long, trigonous, clothed with appressed silvery hairs and a few spreading ones. Leaves 5-7-foliate; petioles  $\frac{3}{16}$ — $\frac{3}{8}$  inch long, hairy; stipules linear, acute, hairy. Leaflets alternate,  $\frac{1}{4}$ — $\frac{3}{8}$  by  $\frac{1}{8}$ — $\frac{3}{16}$  inch, oblanceolate or elliptic, rounded at the apex, densely clothed on both sides with silvery appressed hairs, base acute, petiolules of the lateral leaflets 0— $\frac{1}{16}$  inch, those of the terminal leaflets  $\frac{1}{8}$  inch long.

Flowers in dense sessile villous heads, each consisting of 12—20 sessile flowers; bract minute, ovate-lanceolate, acute, hairy. Calyx  $\frac{1}{8}$ — $\frac{3}{16}$  inch long; teeth long, linear, acute, hairy. Corolla red, scarcely exerted.

Pods  $\frac{1}{4}$  inch long, linear-cylindric, straight, silvery-hairy, torulose, seeds 3—4.

*Locality*:—Aden (Perry).

*Distribution*:—Punjab, Afghanistan, Sind, Aden, Abyssinia.

### 5. *Tephrosia* Pers.

Undershrubs or herbs. Leaves usually imparipinnate, sometimes digitate or simple, stipulate. Leaflets opposite, usually numerous, parallel-veined, often silky beneath.

Calyx-teeth subequal or the 2 upper more deeply connate, or the lower longer. Petals clawed; standard suborbicular, wings obliquely obovate or oblong, keel incurved, obtuse or subacute. Upper stamen free to the base or middle, anthers uniform. Ovary sessile; ovules

usually many; style incurved, often flattened, glabrous or bearded; stigma terminal.

Pod usually linear, flattened, many-seeded, 2-valved. Seeds sometimes with a small strophiole.

*Species* about 100.

*Distribution* :—Tropics of both hemispheres.

Pod 5.— 12-seeded . . . . .	1. <i>Tephrosia apollinea</i> .
Pod 1-seeded . . . . .	2. <i>Tephrosia pogonostigma</i> .

**1. *Tephrosia apollinea*** Link. Enum. Hort. Berol. II, 252; DC. Prodr. II, 254; Boiss. Fl. Or. II, 192; Anders. Journ. Linn. Soc. V, Suppl. p. 16; Oliv. Fl. trop. Afr. II, 126.

*Galega apollinea* Del. Fl. d'Eg. p. 144, tab. 53, fig. 5.

*Arabic name* :—Obēira.

*Description* :—Stems suffruticose, 12–18 inches high, diffusely branched from the base, branches glabrous or sparsely hairy. Leaves  $1\frac{1}{2}$ – $2\frac{1}{2}$  inches long, petioles  $\frac{1}{4}$ – $\frac{1}{2}$  inch long; stipules linear,  $\frac{1}{8}$ – $\frac{1}{6}$  inch long. Leaflets in 2–4 pairs, oblong or oblanceolate, emarginate, mucronate, glabrous above, more or less silky beneath.

Flowers in leaf-opposed lax 6–12-flowered racemes, pedicels  $\frac{1}{8}$  inch long; bracts rigid, subulate. Calyx  $\frac{1}{6}$  inch long, silky; teeth triangular, acute, equalling the tube. Corolla purple, twice the calyx. Style glabrous; stigma penicillate.

Pods  $1\frac{1}{2}$ –3 inches long, 2–3 lines broad, curved upwards, mucronate appressedly thinly hairy, 5–12-seeded.

*Fruits* in Aden in November; *flowers* and *fruits* in Yemen in January (Schweinf.).

*Locality* :—Goldmore Valley (Defl.); plain of Maala (Schweinf.); without locality (Hook., Birdw.).

Near Shaikh Othman (Ellenbeck, Busse).

*Distribution* :—Upper Egypt, Nubia, Libya, Abyssinia, highlands of Somaliland, Socotra, S. Arabia.

**2. *Tephrosia pogonostigma*** (Steud.) Boiss. Fl. Or. II, 193.

*Tephrosia Arabica* Steud. Nomencl. Bot. ed. 2, II, 666.

*Pogonostigma arabicum* Boiss. Diag. Pl. Or. ser. I, II, 39; Anders. Journ. Linn. Soc. V, Suppl. p. 16.

*Psoralea arabica* Hochst. in Schimp. Pl. Arab. n. 775.

*Catacline sericea* Edgew. Journ. As. Soc. Beng. vol. 16, p. 1214.



*Description* :—An undershrub, 1—2 feet high, silky-tomentose, branches ascending. Leaves  $\frac{1}{2}$ — $1\frac{1}{2}$  inches long, petiolate, stipulate, usually bijugate; leaflets 2—6 lines long, opposite, linear-oblong or anceolate, mucronate, softly pubescent on the upper side, silky-tomentose on the lower.

Racemes elongate, subaphyllous. Flowers solitary or 2 together, pedicel 1—2 lines long. Calyx silky; segments subulate, acute. Corolla longer than the calyx; vexillum purple, silky-hirsute on the outer side.

Pod suborbicular, acute, long-apiculate with the persistent style, 1-seeded. Seed olivaceous,  $1\frac{1}{2}$  lines long.

*Flowers* :—December 1889 (Defl.), January 1880 (Balfour), March 1850 (Madden), March 1878 (Perry), April 1894 (Lunt), August 1898 (Birdw.).

*Fruits* :—December 1889 (Defl.), January 1880 (Balfour), February 1851 (Thomson), March 1850 (Madden), March 1878 (Perry), April 1894 (Lunt), June 1872 (Hildebr.), August 1894 (Birdw.), November 1888 (Schweinf.).

*Locality* :—Goldmore Valley, plentiful not far from the sea (Schweinf.); Koosaf Valley (Defl.); gravelly slope of Shum Shum Range (Ellenbeck); Aden port, nearly sea level (Lunt); without locality (Edgew., Madden, Hooker, Thomson, Anderson, Hildebrandt, Balfour, Perry, Birdw.).

*Distribution* :—Yemen, Eritrea.

## 6. *Sesbania Scop.*

Herbs or soft-wooded trees or shrubs. Leaves abruptly pinnate, leaflets numerous, linear-oblong, obtuse, quite entire, mucronate, deciduous.

Flowers in axillary lax racemes. Calyx campanulate, shallowly 2-lipped or 5-toothed. Corolla much exserted; petals all with long claws; standard orbicular, or ovate, spreading or reflexed; wings falcate-oblong; keel obtuse and straight, or subrostrate and recurved. Stamens diadelphous, anthers uniform. Ovary usually stalked, many-ovulate, style incurved, glabrous, stigma small capitate.

Pod very long and narrow, dehiscent, septate transversely between the seeds. Seeds numerous, oblong or subquadrate.

*Species* about 40.

*Distribution* :—Throughout the tropics.

The following tree is planted for ornament in the village of Shaikh Othman :

**1. *Sesbania grandiflora*** Pers. Syn. II (1807) 316; Bedd. Fl. Sylv. 86; Brand For. Fl. 137; Hook. Fl. Brit. Ind. II, 115.

*Aeschynomene grandiflora* Linn. Sp. 1050; Roxb. Fl. Ind. III, 331.

*Agati grandiflora* Desv. Journ. Bot. I (1813) 120.

*Coronilla grandiflora* Willd. Sp. III, 1145.

*Description* :—A short-lived soft wooded tree, 20-30 feet high, with virgate terete branches; leaves  $\frac{1}{2}$  — 1 foot long; leaflets 41 — 61, linear-oblong, pale green, glabrous.

Flowers 2—4 in short axillary racemes. Calyx 1 inch deep, glabrous, shallowly 2-lipped. Corolla 3—4 inches deep and very showy, white or red.

Pod 1 foot long more or less, not torulose, the sutures much thickened.

*Flowers* :—December (Deflers, Schweinf.).

*Distribution* :—Mauritius to North Australia, but often cultivated.

## 7. *Taverniera* DC.

Shrubs with fleshy-herbaceous, simple or pinnately 3-foliate leaves; stipules scarious. Leaflets usually obovate or orbicular, exstipellate.

Flowers in axillary lax racemes. Calyx with a campanulate tube and 5 sub-equal teeth. Corolla much exserted, standard broadly-obovate, narrowed at the base; wings small, keel about equal to the standard, obliquely truncate at the apex. Upper stamen free at the base or altogether; anthers uniform. Ovary stalked, 1—3 ovulate, style filiform, inflexed, stigma terminal.

Pod of 1—3 flattened indehiscent muricated joints. Seeds reniform.

*Species* about 8.

*Distribution* :—Egypt, Abyssinia, Arabia, N.-W. and W. India.

Racemes 5—10-flowered . . . . . 1. *T. glauca*.

Racemes 2—6-flowered . . . . . 2. *T. Schimperii*.

**1. *Taverniera glauca*** Edgew. Journ. Asiat. Soc. Beng. XVI, 1214; Anders. Journ. Linn. Soc. V, Suppl. p. 17.

*Description* :—A glabrous shrub. Leaves unifoliate, fleshy, glabrous, glaucous, rhomboid-ovate, suborbicular, emucronate; stipules 2, small, scarious, cuneate, acute.

Racemes 5 — 10-flowered; bracts shorter than the pedicels, acute, with membranous margins. Vexillum large, concave, subcarinate, shortly emarginate and callous-mucronulate; wings narrow, falcate, elliptic, truncate-auriculate at the base, with a short thin claw much

shorter than the vexillum; keel larger than the vexillum, obtuse. Stamens geniculate at the apex, alternately larger and shorter. Style long, tortuose-geniculate at the base, filiform; stigma apical, punctiform.

Pod 2-articulate, hispid with setaceous hairs.

*Flowers*:—January 1856 (Edgeworth), January 1880 (Balfour), April 1894 (Lunt), November (Schweinf.), November 1884 (Beever).

*Fruits*:—March and November (Schweinf.).

*Locality*:—Goldmore Valley, above the coal-depôt of the Messag. Marit. (Schweinf.); plain of Maala, Biggari Valley (Defl.); on gravelly ground of the Shum Shum Range (Ellenbeck); Aden port, 100 feet high (Lunt); without locality (Edgew., Balfour, Birdw., Beever).

*Distribution*:—Abyssinia.

**2. Taverniera Schimper** Jaub. et Spach Illustr. Pl. Or. t. 474; Oliv. Fl. trop. Afr. II, 141.

*Taverniera cyclophylla* Hochst. in Schimp. Herb. Abyss. 2329.

*Taverniera floribunda* Schweinf. Fl. Aethiop. 17.

*Description*.—A copiously branched shrub, 2 or 3 feet high, with erecto patent terete subglabrous branches. Leaves usually simple, casually pinnately trifoliate, the petiole  $\frac{1}{2}$  inch long, finely silky, geniculate and articulated at the apex, blade obovate,  $\frac{3}{4}$ —1 inch long,  $\frac{1}{2}$ — $\frac{3}{4}$  inch broad, the apex rounded, both sides glabrous and glaucous. Stipules connate into a single small bifid brown scarious deltoid sheath round the base of the petiole.

Flowers very deciduous, in 2—6-flowered racemes on rigid erecto-patent peduncles 1—1 $\frac{1}{2}$  inches long from the axils of the leaves. Pedicels glabrous, equalling the campanulate calyx, which is 2 lines deep, the teeth linear or lanceolate, reaching halfway down. Corolla rose-red, persistent,  $\frac{1}{2}$ — $\frac{5}{8}$  inch deep, the standard  $\frac{1}{2}$  inch broad, the wings not more than 2 lines deep by half as broad.

Pod  $\frac{1}{4}$ — $\frac{3}{8}$  inch long, with 2 or 3 articulations, densely muricated with long bristles all over the surface.

*Locality*:—Aden (Defl.).

*Distribution*:—Abyssinia.

## 8. Alhagi Tourn.

Rigid much-branched spiny shrubs with simple leaves. Stipules small. Flowers in axillary racemes. Calyx campanulate; teeth very short.

subequal. Corolla exserted ; standard obovate, shortly clawed ; wings falcate-oblong ; keel incurved, about equalling the standard and the wings. Stamens diadelphous ; anthers uniform. Ovary stalked ; ovules many ; style filiform incurved ; stigma terminal.

Pod linear jointed, somewhat thick, subterete or compressed, indehiscent, usually contracted between the seeds. Seeds uniform.

*Species 3.*

*Distribution* :—Widely spread from Greece and Egypt, through Western Asia, Afghanistan and Baluchistan, extending over the arid and dry regions of India.

**1. *Alhagi maurorum* Medic.** in Vorles. Churpf. Phys. Ges. II (1787) 397 ; Desv. Journ. I (1813) 120, t. 4 ; DC. Prodr. III, 353.

*Alhagi karduchorum* Boiss. et Haussk. ex Boiss. Fl. Or. II, 559.

*Alhagi mannifera* Desv. Journ. Bot. I (1813) 120.

*Alhagi napaulensium* DC. Prodr. III, 352.

*English name* :—Camel's Thorn.

*Description* :—An erect wiry much-branched shrub, armed with many sharp spreading spines, 1 inch or more long. Leaves simple, drooping from the base of the spines and branches, obovate-oblong, entire, short-stalked, deciduous.

Flowers solitary or in few-flowered secund racemes from the spines on short pedicels. Calyx teeth deltoid, acute. Corolla red, three times as long as the calyx. Ovary silky.

Pod sickle-shaped, 1 inch or more long

*Locality* :—Aden (Birdw.).

*Distribution* :—Nubia, Egypt, Syria.

*Uses* :—The plant yields a kind of oriental manna, which appears in the form of drops, as of honey, on the leaves, and gradually hardens.

## 9. *Rhynchosia* Lour.

Herbs, shrubs or undershrubs, twining or prostrate, rarely erect. Leaves pinnately, rarely digitately 3-foliolate. Leaflets dotted beneath with resinous glands.

Calyx-teeth not accrescent, the upper ones more or less connate, the lowest longer than the others. Standard obovate or orbicular, patent or reflexed, the base appendiculate with inflexed auricles, wings narrow ; keel incurved at the apex. Upper stamen free, the others connate ; anthers uniform. Ovary subsessile, ovules 2, rarely 1 ; style incurved upwards, filiform or incrassated ; stigma small, terminal, capitate.

Pod round or oblong, compressed or turgid, usually continuous within. Seeds 2, rarely 1; the hilum parallel to the sutures and the funicle central upon it; strophiole thick, small or absent.

*Species* :—About 80.

*Distribution* :—Throughout the tropical regions, a few in extra tropical N. America and South Africa.

**1. *Rhynchosia memnonia*** (Del.) DC. Prodr. II, 386; Hook. Fl. Brit. India. II, 224; Oliv. Fl. trop. Afr. II, 220.

*Rhynchosia pulverulenta* Stocks in Kew Journ. Bot. IV, 147; Boiss. Fl. Or. II, 665; Anders. Journ. Linn. Soc. V, Suppl. p. 17.

*Rhynchosia minima* DC. Prodr. II, 386, var. *memnonia* Cooke Fl. Bombay Pres. I, 389.

*Glycine memnonia* Del. Fl. d' Eg. p. 100, tab. 38, fig. 3.

*Description* :—A twining or trailing annual, stems numerous, slender, much branched, canescent with short white velvety persistent pubescence. Leaves 3-foliate; stipules linear-lanceolate. Leaflets  $\frac{3}{8}$ —1 inch long, as broad as long, rhomboid-ovate or rhomboid-obovate, obtuse, apiculate.

Flowers in 6-12-flowered lax racemes, usually exceeding the leaves; pedicels very short. Calyx  $\frac{1}{8}$ — $\frac{1}{6}$  inch long, pubescent; teeth twice the tube, linear-subulate. Corolla yellow.

Pod  $\frac{1}{2}$ — $\frac{5}{8}$  by  $\frac{1}{4}$  inch, somewhat compressed, turgid, slightly recurved. Seeds 2, rarely 1, compressed, black.

*Flowers* : January 1880 (Balfour).

*Flowers* : in Yemen in January, in Eritrea it flowers and fruits in March and April (Schweinf.).

*Locality* :—Valley of the northern slope of the Shum Shum Range (Schweinf.); crater of the Shum Shum Range (Defl.); great valley between Steamer Point and town (Marchesetti); without locality (Hook., Anders., Balfour, Birdw.).

Little Aden : in ravines on the south-western slope of Jebel Muzulghum (Defl.).

*Distribution* :—Egypt, Nubia, Abyssinia, Kordofan, Sennaar, highlands of Somaliland, Kilimandjaro, Angola, Lower Kongo, Natal, Central and South Arabia, Sind.

#### *Suborder 2. Cæsalpiniaceæ.*

Trees, shrubs, rarely herbs. Leaves alternate, 1-2-pinnate, simple or 3-foliate, usually stipulate.

Inflorescence very various. Flowers irregular, rarely regular. Sepals 5, 2 posterior sometimes coherent throughout, connate below or free to the base, imbricate or rarely valvate. Petals 5, or fewer by abortion

or 0, posterior included in aestivation. Stamens 10 or fewer by abortion, rarely more; filaments usually free, rarely coherent; anthers various. Ovary sessile or stipitate; stipes often adnate to the calyx-tube.

Pods dehiscent or indehiscent. Seeds various, with or without albumen.

*Distribution*:—Tropical and warm regions.

Leaves bipinnate.

Calyx-segments valvate or slightly overlapping.

Pod flat . . . . . 1. Poinciana.

Pod turgid . . . . . 3. Parkinsonia.

Calyx-segments imbricate . . . . . 4. Cæsalpinia.

Leaves simply pinnate . . . . . 2. Cassia.

### 1. Poinciana L.

Unarmed trees. Leaves bipinnate. Leaflets small, numerous, exstipellate.

Flowers in corymbose racemes; bracts small, caducous. Calyx deeply cleft; tube short; segments valvate, subequal. Petals 5, imbricate, subequal. Stamens 10, free, declinate; filaments filiform, pubescent or villous at the base; anthers uniform. Ovary subsessile,  $\infty$ -ovulate; style elongate, filiform; stigma truncate, ciliate.

Legume bivalved, elongate, flat, dehiscent. Seeds transverse, oblong, albuminous; cotyledons rather thick; radicle short, exserted.

*Species*:—3.

*Distribution*:—Tropical Asia and Africa.

**1. Poinciana elata** L. Mant. p. 16; DC. Prodr. II, 484; Hook. Fl. Brit. Ind. II, 260; Oliv. Fl. trop. Afr. II, 266.

Cæsalpinia elata Sw. Obs. 166.

*Arabic Name*:—Runf.

*Description*:—An erect tree, 20—30 feet high; bark tolerably smooth, ash-coloured. Leaves abruptly bipinnate, 4-8 inches long; pinnae 4-8 pairs, opposite; leaflets 10-20 pairs, subsessile, closely set along the rachis, linear-oblong, rounded and usually apiculate at the apex.

Flowers in terminal, few-flowered, corymbose racemes; pedicels stout, finely pubescent; bracts lanceolate or ovate-oblong. Calyx-lobes coriaceous, oblong or oblanceolate, pointed or obtuse. Petals 4, white, one greenish-yellow, all turning orange when fading, rather longer than the calyx, with a broadly obovate or rotundate-cuneate crisped lamina. Filaments much exceeding the petals, 2-4 inches long, villous and thickened below. Style elongate, filiform.

Pods 6-8 by  $\frac{3}{4}$ -1 $\frac{1}{2}$  inches, attenuated at both ends, reticulately veined, supported by persistent calyx. Seeds 4-8, much compressed, elliptic-oblong, smooth.

*Flowers*.—April 1878 (Perry), April 1861 (Thomson), Nov. (Schweinf.), February 1880 (Balfour), March 1875 (Hildebr.).

*Fruits*.—Nov. (Schweinf.), April 1861 (Thomson), March 1875 (Hildebr.).

*Locality*.—Near the fisher-huts at the entrance of the Goldmore Valley (Defl.); gravelly slope of Shum Shum Range (Ellenbeek); in the flats of the valleys on the South-West side of Aden (Perry); without locality (Annesley, Birdw., Hildebrandt, Balfour).

*Distribution*.—Nubia, Abyssinia, Eritrea, highlands of Somaliland, Usagara-Usambara, Kilimandjaro, Central and Southern Arabia, Western India (?).

*Note*.—The Gardeners' Chronicle (1861, p. 388) contains a short notice by T. Anderson on "*Poinciana Playfairii*". He says: "This (*P. Playf.*) I see you mention as living at Kew. It is a manuscript name given by me on collecting the plant at Aden in February 1861, after the publication of my "*Florula Adenensis*." I have specimens in my herbarium in good flower and fruit, and a young plant 5 feet high raised from seed recently received from Aden, is also in this garden. I hope soon to describe the species if it proves to be different from *P. elata*, Linn."

The Index Kewensis refers to this note; but after this nothing seems to have been published on this supposed new species. We found a small bit of a specimen of "*Poinciana Playfairii*" in the Kew Herbarium, but judging from that, there can scarcely be a doubt that *P. Playfairii* is identical with *Poinciana elata*, Linn.

*Poinciana elata* "grows from 8—15 feet high in the flats of the valleys on the South-West side of Aden. One of these valleys is called by the Indian Residents of Aden 'Gold Mohur Valley' from this tree. It does not appear to grow anywhere in the northern crater." Perry in folio Herb. Kew.

## 2. Cassia L.

Trees, shrubs or herbs. Leaves abruptly pinnate; common petiole frequently with sessile or stipulate glands; stipules various.

Flowers yellow or red, in axillary or terminal racemes or fascicles, or subsolitary in axils. Calyx-tube very short, segments 5, imbricate in æstivation. Petals 5, subequal or the anterior larger, imbricate. Stamens 10, all perfect and subequal or 3 or 5 wanting, or imperfect, anthers uniform or those of the lower stamens the larger. Ovary

sessile or stipitate ; ovules many ; style short or elongate ; stigma terminal.

Pod terete or flat, usually septate between the seeds, dehiscent or indehiscent. Seeds transverse, rarely longitudinal, horizontally or vertically compressed, albuminous. Cotyledons plane or sinuous.

*Species* about 380.

*Distribution* :—The Tropics ; a few extra-tropical.

Stipules lanceolate or subulate—

Valves of legume with a row of crest-like plates . . . 1. *C. obovata*.

Valves of legume unappendaged--

Leaflets 5—8 pairs, obtuse, pubescent . . . 2. *C. holosericea*.

Leaflets 5—8 pairs, acute, glabrous . . . 3. *C. angustifolia*.

Stipules narrow-cuspidate . . . 4. *C. adenensis*.

Stipules large, rotundato-reniform (cultivated) . . . 5. *C. auriculata*.

**1. *Cassia obovata* (L.) Collad. Hist. Cass. p. 92, tab. XV, A ; DC. Prodr. II, 492 ; A. Rich. Tent. Fl. Abyss. I, 249 ; Anders. Journ. Linn. Soc. V, Suppl. p. 18 ; Boiss. Fl. Or. II, 631 ; Hook. Fl. Brit. Ind. II, 264 ; Oliv. Fl. trop. Afr. II, 277 ; A. Terrac. Fl. d'Anfilha p. 24.**

*Cassia senna* L. Sp. Pl. 539 (*ex parte*).

*Cassia obtusa* Roxb. Hort. Beng. p. 31.

*Senna obtusa* Roxb. Fl. Ind. II, 344.

*Cassia Burmanni* Wight in Madras Journ. VI, 5.

*Cassia aschrek* Forsk. Fl. Aeg.-Arab. p. 86.

*Names* :—Sreissi, Aschirák (Arabic) ; sometimes called Jamaica Senna, Italian Senna, Country Senna.

*Description* :—Herbaceous, perennial, erect or ascending from a woody stock, 1—4 feet high. Branches spreading, glabrous, except the very young parts. Leaves 2—5 inches long ; petioles  $\frac{1}{2}$ — $\frac{3}{4}$  inch long ; stipules  $\frac{1}{4}$  inch long, obliquely lanceolate, very acute. Leaflets 3—6, rarely 7 pairs,  $\frac{3}{4}$ —1 by  $\frac{3}{8}$ — $\frac{1}{2}$  inch, broadly oblong or obovate-oblong, obtuse, mucronate, pale green above, glaucous or puberulous beneath, base obtuse.

Racemes erect, axillary, at length usually overtopping the leaves, rather laxly many-flowered. Sepals rather unequal, very obtuse. Petals  $\frac{1}{2}$  inch long, obovate-oblong, shortly clawed, yellow. Perfect stamens 7, very unequal, the 2 or 3 lowest much the largest, the staminodes minute ; filaments short. Ovary appressed-tomentose.

Legume flat, oblong-reniform, broadly rounded at the extremity and obliquely tipped with the remains of the slender style,  $1\frac{1}{4}$ — $2\frac{1}{4}$  inches long, 7—10 lines broad ; valves membranous, glabrous or pulverulent, transversely marked with anastomosing veins, and longitudinally over



the seeds with a single series of crest-like plates. Seeds 6—12, wedge-shaped, truncate or retuse at the apex, finely reticulate-rugose, dark-brown, shining.

*Flowers*:—March 1888 (Schweinf.), July 1874 (Perry).

*Fruits*:—August 1880 (Balfour), Nov. (Schweinf.), July 1879 (Perry).

*Locality*:—East of Steamer Point, near the telegraph-office (Schweinf.); plain of Maala (Defl.); great valley between Steamer Point and town (Marchesetti); slope of Shum Shum Range (Ellenbeck); without locality (Hook., Birdw., Perry, Balfour).

*Distribution*:—W. India, Sind, Arabia, Palestine, Egypt, Nubia, Eritrea, Abyssinia, Kordofan-Sennaar, highlands of Somaliland, Senegambia, Angola, Hereroland.

*Note*:—We have included Forskal's synonym (*C. aschrek*) on the authority of Schweinfurth. Forskal's short diagnosis seems to agree completely with the characteristics of *Cassia obovata*. Also the arabic name and the locality point to the species growing in Southern Arabia. Ehrenberg, too, found the species in the vicinity of Mor.

*Uses*:—This plant is occasionally to be seen in Indian bazars as an inferior quality of Senna. (Greenish, in Pharmaceut. Journal, 4th ser., vol. 9, p. 470—471.)

**2. *Cassia holosericea*** Fresen. in Flora (1839) I, 54; Franch. Sert. Somal. in Miss. Révoil p. 30; Oliv. Fl. trop. Afr. II, 278.

*Cassia pubescens* R. Br. in Salt Abyss. App. p. 64.

*Cassia Schimper* Steud. Nomencl. Bot. ed. 2, I, 307.

*Cassia cana* Wenderoth in Linnaea XII, 22.

*Description*:—Shrubby, 1—4 feet high; entire plant usually clothed with a short, dense or subvelvety pubescence. Leaves 2—5 inches long; stipules  $\frac{1}{4}$  inch long, linear-lanceolate, very acute with a small auricle at the base. Leaflets 5—8 pairs,  $\frac{5}{8}$ —1 by  $\frac{1}{8}$ — $\frac{1}{4}$  inch, obovate-oblong, obtuse or retuse, mucronate, base obliquely rounded or subacute.

Flowers in narrow axillary racemes shorter than the leaves. Calyx  $\frac{3}{8}$  inch long, divided at the base; segments oblong, obtuse, membranous. Petals  $\frac{1}{2}$  inch long, obovate-oblong, cuneate, shortly clawed, yellow. Stamens 10, the 3 upper reduced to small staminodes. Ovary densely pubescent.

Pods 1—1 $\frac{1}{2}$  by  $\frac{1}{2}$ — $\frac{3}{4}$  inch, flat, papery, recurved, rounded at both ends, transversely veined. Seeds 4—10, obovoid-cuneate,  $\frac{1}{4}$  by  $\frac{1}{8}$  inch, retuse at the apex, reticulate-rugose, flattened, yellow.

*Flowers*:—January 1863 (Oliver and Cl.), February 1851 (Hooker), March 1878 (Perry), April 1861 (Thomson), August 1898 (Birdw.).

*Fruits* :—January 1863 (Oliver and Cl.), March 1878 (Perry), March 1888 (Schweinf.), April 1861 (Thomson), Dec. 1847 (Hooker).

*Locality* :—Great valley between Steamer Point and town (Marchesetti) ; without locality (Hook., Anders., Thomson, Birdw., Schweinf., Perry, Oliver and Cl.).

*Distribution* :—Nubia, Eritrea, Central and Southern Arabia, Socotra, Sind.

**3. *Cassia angustifolia* Vahl. Symb. Bot. I, 29.**

*Cassia lanceolata* Wall. Cat. n. 5318 ; Royle Ill. t. 37 ; W. et A. Prodr. Fl. Pen. Ind. Or. p. 288.

*Senna officinalis* Roxb. Fl. Ind. II, 346.

*Arabic Name* :—Ssonna (Schweinf.).

*Description* :—Shrub or undershrub with pale subterete or obtusely angled erect or ascending branches. Leaves usually 5—8-jugate ; leaflets oval-lanceolate, glabrous.

Racemes axillary, erect, laxly many-flowered, usually considerably exceeding the subtending leaf. Bracts membranous, ovate or obovate, caducous. Sepals obtuse, membranous.

Legume flat, 7—8 lines in breadth. Seeds obovate, cuneate, compressed ; cotyledons plane.

*Locality* :—(Aden Birdw., Schweinf.).

*Distribution* :—Mozambique (near Tette), extending eastward to the desert tracts of North-Western and Peninsular India.

*Note* :—Dalzell and Gibson (Bombay Flora, Suppl. p. 29) wrote in 1861 :—

“It certainly grows wild in Sind. The narrow-lanceolate leaves, and peculiar broad falcate legume, at once distinguish it from our other Cassias, of which *C. obovata* is the only one having a similar legume. Introduced at Hewra from seed furnished by Captain Haines from Aden ; is now largely cultivated by ryots near the Hewra garden, from whence it is supplied to the Medical Stores, quite free from all admixture of other leaves.”

*Uses* :—“Adams (Comment. in Paulus Aegineta, III, 431—33) gives a most interesting sketch of the early knowledge in Senna. He says Serapion was undoubtedly the first author who describes the drug as an article of the Materia Medica. He, however, quotes still other writers such as Isaac Ebn Amram and Abix. All the Arab physicians, in fact, extol the merits of Senna in purging black or yellow bile and in acting as a cordial when mixed with suitable drugs, such as violets. The present species, as also the Alexandrian (*C. acutifolia*, Delile), were introduced to both Indian and European pharmacy through the Arabs. The

former species (the only one grown in India) is fairly extensively produced in Tinnevely, and recently its cultivation has been extended to Madura and Trichinopoly, districts of South India, and to Poona in Bombay.

"Indian senna is either exported coastwise to Bombay and thence to foreign countries, or is consigned direct from Tuticorin. The drug is also imported from Arabia, where it is collected from the wild plant and accordingly often much adulterated. It would appear that about 5,000 cwt. are usually taken by India and again re-exported under the name of East Indian Senna or Moka or Aden Senna, and is thus no doubt the true sanna (sona)—kokki (maki) or sanna hajazi. For many years past, however, the imports from Arabia have been declining and the exports of Tinnevely senna improving. The purity, high quality and low price of the Indian article place it in the front rank." (Watt, Commercial Products of India, London, 1908, p. 288).

Cf. also : Ibn-el-Beithar. II, 293—294.

**4. *Cassia adenensis*** Benth. Trans. Linn. Soc. XXVII, 553.

*Senna Hookeriana* Batka Monogr. Senn. p. 52.

*Cassia lanceolata* Deff. Bull. Soc. Bot. France (non Wall.).

*Arabic name* :—Ssonna.

*Description* :—A glabrous undershrub ; branches angular-terete, stout, sulcate. Leaves 3—7—8-jugate, petiolate ; leaflets ovate, distinctly petiolate, scarcely mucronulate, green on both sides, glabrous, cartilaginous on the margins ; stipules persistent, long, narrow-cuspidate.

Racemes usually longer than the leaves. Corolla twice as long as the calyx.

Pods subtransparent, numerous, oblong, of a peculiar flavescent colour ; peduncles revolute, about  $1\frac{2}{5}$  inches long and  $\frac{2}{3}$  inch broad. Seeds rugulose-scribulate, green. Cotyledon distinctly emarginate, intensely flavo-lutescent.

*Flowers* :—April 1861 (Thomson), June 1872 (Hildebr.), July 1878 (Perry), Nov. (Schweinf.).

*Fruits* :—April 1861 (Thomson), June 1872 (Hildebr.), July 1878 (Perry).

*Locality* :—Plain of Maala (Schweinf., Deff.) ; near the Telegraph office not far from the seashore (Lunt) ; without locality (Hooker, Thomson, Oliver and Cl., Hildebrandt, Perry, Kuntze).

*Distribution* :—Hadramaut, Bakrais near Mokalla, Somaliland.

*Note* :—This plant has not got the penetrating odour nor the peculiar taste of the officinal species of the genus *Cassia*.

"In planta hacce vegetant Hyphomycetes qui a nonnullis glandulæ capitulatæ vocantur; a me autem partes hac byssi ex facie putredine partium novellarum et succulentarum ortæcontestantur." Batka in folio Herb. Kew.

The following species is grown as an ornamental tree near a well at Shaikh Othman :

**5. Cassia auriculata** L. Sp. Pl. (1753) p. 379; Schweinf. Bull. Herb. Boiss. 1896, App. II, 221.

*Name* :—Tanner's Cassia.

*Description* :—A tall much-branched shrub; bark smooth, reddish-brown; branchlets finely pubescent. Leaves 3—4 inches long; rhachis densely fulvous-pubescent with an erect linear gland between each pair of leaflets; stipules foliaceous, reflexed, very large, rotundato-reniform, produced at the base on the side next the petiole into a long subulate point, persistent. Leaflets 8—12 pairs,  $\frac{3}{4}$ —1 by  $\frac{3}{8}$ — $\frac{1}{2}$  inch, slightly overlapping, oblong-obovate, obtuse or emarginate, mucronate, glabrous or finely downy, dull green above, paler beneath, base usually rounded; petioles  $\frac{1}{2}$  inch long.

Flowers large, reaching 2 inches across, in terminal and axillary corymbose racemes; pedicels  $\frac{3}{4}$ —1 inch long; bracts ovate, acuminate, caducous. Calyx glabrous; segments leathery, concave, the 2 outer much smaller than the other 3. Petals with long claws, crisped on the margin, bright yellow, veined with orange. Stamens 10, of which the 3 upper are reduced to staminodes, the remaining 7 perfect, of which the 3 lower are longer than the 4 lateral ones.

Pods 3—5 by  $\frac{1}{2}$ — $\frac{5}{8}$  inch, flat, thin, papery, oblong, obtuse, mucronate, pale brown, deeply depressed between the seeds, having a crumpled appearance, transversely veined, pubescent.

*Flowers and fruits* :—November (Schweinf.).

*Distribution* :—India and Ceylon (common on dry stony hills and on black soils).

*Uses* :—The bark is largely used in tanning and gives a buff-coloured leather. The seeds are valued as a local application in purulent ophthalmia. An infusion of the leaves is esteemed as a cooling medicine and as a substitute for tea. The root is said to be of great value in tempering iron metal.

### 3. Parkinsonia Plum.

Shrubs or small trees. Leaves bipinnate; pinnae 2—6, very long, flattened. Leaflets numerous, small, oblong or linear, opposite or scattered.

Flowers in lax axillary racemes; bracts small caducous. Calyx divided nearly to the base; segments 5, membranous, slightly unequal, imbricate or subvalvate. Petals 5, spreading, the upper the broadest. Stamens 10, free; filaments pilose at the base; anthers uniform, versatile. Ovary narrowed to the base, many-ovuled; style subfiliform; stigma terminal.

Pod turgid, moniliform, finally dehiscent. Seeds 1—6 or 8, oblong or subcylindrical, albuminous.

*Species 3.*

*Distribution*:—America and the Cape.

The following species is cultivated near the tanks of Aden (Busse) and in the village of Shaikh Othman (Defl.).

#### **I. *Parkinsonia aculeata* L. DC. Prodr. II, 486.**

*Description*:—A glabrous shrub or small tree with sharp woody spines. Pinnæ 1—3 pairs, 6—12 inches long, rhachis flattened, striate. Leaflets numerous, minute, oblanceolate, obtuse.

Flowers in lax axillary racemes; pedicels  $\frac{3}{8}$ — $\frac{5}{8}$  inch long, jointed near the top. Calyx  $\frac{1}{2}$  inch long, divided nearly to the base; segments oblong, obtuse. Petals yellow, broadly obovate or suborbicular, with a villous claw. Filaments flattened, villous at the base. Ovary silky-villous; ovules many.

Pods 3—4 by  $\frac{1}{4}$ — $\frac{3}{8}$  inch, moniliform, attenuated at both ends, glabrous.

This plant is indigenous in tropical America, but cultivated in most tropical countries. In India it is naturalized, where it is grown chiefly as a hedge plant in the drier districts.

*Uses*:—The natives of Aden use this plant for various purposes. The bark is employed against consumption in cattle, the flowers and seeds against fever, and the bast for the manufacture of paper.

#### **4. *Cæsalpinia* Linn.**

Trees or climbing shrubs, unarmed or armed. Leaves large, abruptly pinnate; stipules various.

Flowers yellow or red, in axillary or terminal racemes or panicles. Calyx deeply cleft, with the disk confined to its base; segments 5, imbricate, the lowest concave or boat-shaped. Petals distinctly clawed, orbicular (rarely oblong), spreading, imbricate, subequal or the uppermost (the inner) smaller than the others. Stamens 10, free, declinate; filaments often villous or glandular at the base; anthers uniform, dehiscing longitudinally. Ovary sessile or subsessile; ovules few; style filiform, sometimes clavate at the apex; stigma terminal.

Pod oblong or ligulate, flat or turgid, indehiscent or dehiscent, smooth or prickly.

*Species* about 40.

*Distribution*:—Tropics of both hemispheres.

**1. *Caesalpinia pulcherrima* Swartz** Obs. p. 166.; Hook. Fl. Brit. Ind. II, 255.

*Poinciana pulcherrima* Linn. Sp. Pl. 380; Bot. Mag. t. 995.

*Description*:—A glabrous shrub or small tree, unarmed or with a few weak prickles. Leaves 4-6 inches long; pinnæ 6-8 pairs; leaflets 8-12 pairs, sessile, close, membranous,  $\frac{1}{2}$ — $\frac{3}{4}$  inch long, very obtuse.

Racemes very broad, the lower pedicels 3-4 inches long. Calyx  $\frac{1}{2}$ — $\frac{5}{8}$  inch long, glabrous. Petals round, crisped, reddish-yellow, with a very distinct claw, the largest and most showy of all the species. Filaments bright red, 3-4 times the length of the corolla. Pods nearly straight, 2-3 inches long,  $\frac{3}{8}$  inch broad.

*Locality*:—Aden (Lunt). Introduced.

*Distribution*:—Home unknown. Has been found, apparently wild, by T. H. Aplin, in December 1887, in the Tapel Choung valley, Shan States, 1,700-5,000 feet.

### *Suborder 3. Mimoseæ.*

Shrubs or trees, rarely herbs. Leaves bipinnate, rarely simply pinnate.

Flowers small, regular, usually pentamerous, in globose heads or cylindric spikes, rarely shortly pedicelled and in slender racemes or globose umbels. Sepals usually connate in a 5-dentate or-lobed calyx. Petals free or connate, hypogynous or subperigynous, valvate in æstivation. Stamens as many or twice as many as petals or indefinite, free or monadelphous; anthers minute, dehiscing longitudinally. Ovary free, in the bottom of the calyx.

Seeds albuminous or with scanty albumen; cotyledons flat; radicle straight, shortly exerted or included.

*Distribution*:—Tropical and warm regions.

Stamens indefinite, free anthers without glands . . .	1. <i>Acacia</i> .
Stamens 10, anthers with deciduous apical glands . . .	2. <i>Prosopis</i> .
Stamens indefinite, monadelphous . . . . .	3. <i>Calliandra</i> .

Nos. 2 and 3 are represented by cultivated species only.

### **1. *Acacia* Willd.**

Trees, shrubs and climbers, armed with stipular, infra-stipular or scattered spines. Leaves bipinnate, pinnæ and leaflets opposite. Stipules spinescent or inconspicuous, rarely membranous.

Flowers yellow or white, in globose heads or cylindrical spikes; numerous scaly bracteoles between the flowers; peduncles axillary, solitary or fascicled or panicle at the end of the branches. Calyx and corolla 4—5-merous. Calyx campanulate or funnel-shaped, dentate or lobed. Petals free or more or less united, valvate. Stamens indefinite, exserted, free or consolidated at the base with the disk. Ovary sessile or stalked; ovules many; style filiform; stigma small, terminal.

Legume usually linear or oblong, flat, convex or terete, straight, falcate or twisted, membranous, coriaceous or woody, dehiscent or indehiscent.

*Species* about 450.

*Distribution*:—The leaf-bearing groups throughout the tropical and subtropical regions; the phyllodineous ones almost restricted to Australia.—

A.—Flowers spicate—

I. Leaflets 1-jugate . . . . . 6. *A. mellifera*.

II. Leaflets 2—10-jugate—

Spines 3 together . . . . . 3. *A. hamulosa*.

Spines not 3 together . . . . . 7. *A. læta*.

B.—Flowers capitate—

I. Bract almost at the base of peduncle . . . . . 2. *A. Edgeworthii*.

II. Bract near the apex of peduncle . . . . . 9. *A. Farnesiana*.

III. Bract between apex and base of peduncle.

1. Pod not or scarcely curved—

A. Pod not constricted—

\* Pod pilose . . . . . 5. *A. nubica*.

\* \* Pod not pilose . . . . . 1. *A. eburnea*.

B. Pod constricted . . . . . 8. *A. arabica*.

2. Pod spirally contorted . . . . . 4. *A. spirocarpa*.

*Uses*:—What is true of the Indian species of *Acacia* with regard to their economic value, may, on the whole, be applied to the species described below.

The bushy and arborescent forms, as a rule, afford astringent barks, leaves, or pods, and are appreciated as medicines, as tans or as dye auxiliaries. Some of them afford useful gums that are more or less soluble and edible. The trees are of great value both as sources of timber and fuel. The leaves beaten from the twigs afford a much-valued fodder to the cattle. For detailed information on the different species we refer to Watt's publications and Wiesner, *Die Rohstoffe des Pflanzenreiches*.

1. *Acacia eburnea* (L.) Willd. Sp. Pl. IV, 1081; DC. Prodr. II, 461; Benth. Lond. Journ. Bot. I, 501 et Trans. Linn. Soc. XXX, 511; Boiss. Fl. Or. II, 637; Anders. Journ. Linn. Soc. V, Suppl. p. 19.

*Mimosa eburnea* L. Mant. p. 437.

*Description* :—A large shrub or small tree ; branches and leaves ferruginous-villous. Branches armed with straight stipular spines, mostly stout, ivory-white, 1—2 inches long. Leaves small, often shorter than the spines, clothed with long hairs ; pinnæ 4—8, small, scarcely 2 lines long, with a petiolar gland ; leaflets densely arranged, 8—12 pair, linear, acute ; peduncles axillary with a bract below the middle.

Flowers yellow, with an unpleasant smell ; heads under  $\frac{1}{2}$  inch in diameter, fasciculate, reddish brown while in bud.

Pod 2—5 inches long,  $\frac{1}{3}$ — $\frac{2}{5}$  inch broad, linear, slender, flat, veined, generally 2—4 from one flower-head, edges undulate. Seeds (in Schweinfurth's specimens 5—7 in one pod) dark-grey, oval-spherical,  $\frac{1}{4}$  inch long, almost  $\frac{1}{2}$  as broad, very little laterally compressed.

*Flowers and fruits* :—December (Schweinf).

*Locality* :—In the Upper Wadi Maala, not far from the top of the Shum Shum Range (Schweinf.) ; Goldmore Valley (Defl.) ; great valley between Steamer Point and town (Marchesetti) ; without locality (Hook., Anders., Birdw.).

*Distribution* :—Ceylon, Deccan, Sind, Salt Range, Subhimalayan tract and outer valleys, ascending to 3,000 feet, east as far as Oudh, Baluchistan, Afghanistan, Arabia.

**2. *Acacia Edgeworthii*** (Edgew.) Anders. Journ. Linn. Soc. V, Suppl. p. 18 ; Benth. Trans. Linn. Soc. XXX, 504.

*Acacia erioloba* Edgew. Journ. As. Soc. Beng. XVI, 1215 (non E. Mey.).

*Arabic name* :—Ssamma, Khareb, Quaratt.

*Description* :—Low shrub ; stem glaucous ; young branches often pubescent ; pinnæ 3—6-jugate ; petioles subtomentose ; spines straight, long, albescent or puberulous ; leaflets 6—10-jugate, linear, obtuse, minutely pruinose.

Flowers white ; peduncles shorter than the leaves ; bracts almost at the base of the peduncle (not above the middle as stated by Benth. l. c.). Filaments white ; anthers yellow.

Pod 5 inches long, 4 lines broad, linear, falciform, tomentose, obscurely striate, 14-seeded (Anderson).

*Flowers* :—November to March.

*Fruits* :—March (Schweinf.).

*Locality* :—Wadi Maala, Goldmore Valley (Schweinf.) ; plain of Maala (Defl.) ; above the town on rocks (Busse) ; common (Edgew. Hook., Anders.).

*Distribution* :—Yemen (Defl.).



3. *Acacia hamulosa* (Willd.) Benth. Lond. Journ. Bot. I, 509 ; Anders. Journ. Linn. Soc. V, Suppl. p. 19.

*Acacia asak* Willd. Sp. Pl. IV, 1077 ; Schweinf. Bull. Herb. Boiss. 1894, App. II, 215.

*Acacia Hunteri* Oliv. in Hook. Ic. Pl. tab. 1350 ?

*Description* :—A densely branched low shrub, 8 feet high, divaricate, armed with sharp spines. Spines 3 together, the infrastipular ones straight, the intrapetiolar one hooked-recurved, nigrescent when old. Leaves 1—1½ inches long ; petioles aculeate ; pinnae 2—3-jugate, the lower ones subopposite or alternate ; leaflets 3—6-jugate, obliquely oblong, obtuse, glabrous.

Flowers in lax spikes, white ; peduncles axillary, at the end longer than the leaf ; fruiting peduncle 2½ inches long.

Pod 3½ inches long, 1½ inches broad, ovate, linear, rounded at both ends, mucronulate, indehiscent ; valves membranous, plane, glabrous. Seeds 1—2 [2—4 in the specimens from Saati, Eritrea].

*Flowers* :—December (Schweinf.), September 1880 (Hunter).

*Fruits* :—March and December (Schweinf.), December 1889 (Defl.), September 1880 (Hunter).

*Locality* :—Above the coal depôt of the Messag. Marit., Wadi Maala, Shum Shum Range (Schweinf.) ; plain of Maala (Defl.) ; in valleys (Hook., Anders.) ; great valley between Steamer-Point and town (Marchesetti) ; without locality (Birdw.).

*Distribution* :—Eritrea, Jeddah, Yemen, Hadramaut.

*Note* :—D. Oliver described and figured a plant in Hooker's *Icones Plantarum* (tab. 1350) under the name of *Acacia Hunteri*, which Hunter had found in the "neighbourhood of Aden."

It is doubtful whether this species is identical with *Acacia hamulosa*. Schweinfurth is of opinion, that Oliver's plant is nothing but a small-leaved and small-fruited specimen of Bentham's *A. hamulosa*. The description of the flowers and leaves as far as it goes agrees in every detail with that of *A. asak* Willd. It must, besides, not be forgotten, that many species of *Acacia* show a tendency towards developing forms with smaller leaves and fruits. If Schweinfurth says that the leaves of his own specimens are linear-oblong, oblong and obovate-oblong, and always rounded at both ends, it should be remembered that Oliver figured just that type of leaf which is less common in his *A. Hunteri*, for he says in his diagnosis : "foliolis latiuscule oblongis obtusis vel interdum obscure mucronulatis."

In order to enable botanists to clear up on the spot any doubtful point as to the identity of *A. Hunteri*, we think it advisable to add Oliver's description of this species from Hooker's *Icones Pl.* p. 36 :

"Glabrata, pallida ; aculeis ternis rectis vel curvulis, foliis parvis, pinnis 2—3-jugis ; foliolis latiuscule oblongis obtusis vel interdum obscure mucronulatis basi oblique subcordatis glabris, rhachide puberula, floribus spicatis sessilibus, spicis breviter pedunculatis, calyce campanulato puberulo, petalis oblanceolatis mucronulatis, legumine oblongo stipitato, valvis obtusis mucronatis transverse venulosis puberulis.

"Folia  $\frac{1}{3}$ — $\frac{1}{2}$  poll. longa, rhachide puberula ; foliola ad 1 lin. longa. Inflorescentia cum pedunculo  $\frac{1}{2}$ — $\frac{3}{4}$  poll. longa. Legumen  $\frac{3}{4}$ — $1\frac{1}{4}$  poll. long.,  $\frac{1}{3}$  poll. lat., 1—3-sperm."

**4. *Acacia spirocarpa*** (Forsk.) Hochst. in Schimp. Pl. Abyss. n. 658 et in A. Rich. Tent. Fl. Abyss. I, 239 ; Schweinf. Linnæa XXXV, 332, tab. IV—VI ; Oliv. Fl. trop. Afr. II, 352 ; Benth. Trans. Linn. Soc. XXX, 505.

*Mimosa tortilis* Forsk. Fl. Aeg.-Arab. p. 176 ?

*Acacia nubica*  $\beta$  pubescens A. Terrac. Fl. d'Anfilha, p. 24.

*Arabic name* :—Ssammor or Ssamr (Schweinf.).

*Description* :—A low tree ; extremities red-brown, pubescent. Stipular spines patent, straight, slender, varying in length to  $2\frac{1}{2}$  inches sometimes on the same branch, hooked or obsolete. Leaves short,  $\frac{1}{2}$ —2 inches long, petioles pubescent ; pinnæ in 4—10 pairs ; leaflets very small, oblong, in 7—15 pairs.

Peduncles 1 or few, axillary, bearing the minute involucl below or near the middle. Flowers capitate.

Pod spirally twisted or contorted, linear, compressed, slightly constricted between the seeds, valves coriaceous, longitudinally nerved, pubescent or puberulous, 3—6 inches long,  $\frac{1}{4}$ — $\frac{1}{3}$  inch broad.

*Fruits* in March (Schweinf.).

*Locality* :—Above the coal depôt of the Messag. Marit., Goldmore Valley, plain of Maala (Schweinf.) ; without locality (Birdw.).

Near Shaikh O'thman (Busse).

*Distribution* :—S. Arabia, Eritrea, Abyssinia, Nubia.

**5. *Acacia nubica*** Benth. in Lond. Journ. Bot. (1842), p. 498.

*Acacia aucheri* Benth. in Lond. Journ. Bot. (1842), p. 498.

*Acacia pterygocarpa* Hochst., Benth. in Journ. Bot. (1846), p. 96.

*Description* :—Shrubs ; branches glabrescent ; young shoots at first pubescent. Stipular spines straight or slightly curved. Pinnæ in 3—12 pairs ; rhachis with 2 or 3 minute sessile glands, or without glands ; leaflets in 6—15 pairs, oblong, obtuse, or broadly pointed, glaucous, 2—3 lines long.

Peduncles 1—3 from each axil, about  $\frac{1}{2}$  inch long. Calyx-teeth short, rounded. Petals connate nearly throughout, scarcely twice the calyx.

Pod linear-oblong, straight or nearly so, compressed, narrowed at each end, margins narrowly compressed, valves continuous, slightly convex, firmly coriaceous, faintly longitudinally striate, yellowish-grey, puberulous, 5—10-seeded, 2—3 inches long.

*Fruits*:—March 1878 (Perry).

*Locality*:—Aden (Birdw., Perry, Beever).

*Distribution*:—Abyssinia, Nubia.

**6. *Acacia mellifera*** (Forsk.) A. Rich. Tent. Fl. Abyss. I, 241; Benth. Lond. Journ. Bot. I, 507 et Trans. Linn. Soc. XXX, 517; Schweinf. Linnæa XXXV, 365; Oliv. Fl. trop. Afr. II, 340.

*Mimosa unguis cati* Forsk. Fl. Aeg.-Arab. p. 176.

*Mimosa mellifera* Vahl Symb. III, 103.

*Inga mellifera* Willd. Sp. Pl. IV, 1006.

*Arabic name*:—Dsab, Kittir or Tekker.

*Description*:—A shrub or small tree, wholly glabrous, with brownish or sometimes pale and glaucous extremities, unarmed excepting a pair of short recurved infra-stipular prickles, usually below each node. Leaves as broad as long, not exceeding 1—2 inches, glaucous at least beneath; pinnæ in 2 pairs; leaflets unjugate, obliquely obovate-oblong or obovate-rotundate, obtuse entire or retuse, the larger leaflets  $\frac{1}{3}$ — $\frac{1}{2}$  inch long.

Spikes axillary, fascicled, equalling or exceeding the leaves. Pedicels about equalling the short truncate purple calyx. Petals 3—5 times longer than the calyx, apparently united to the middle. Stamens white. Flowers with the odour of *Syringa*.

Legume flat, few-seeded, oblong, continuous or sinuous, apiculate, narrowed at the base, valves thinly coriaceous, transversely venose, pale and glabrous,  $1\frac{1}{2}$ —2 inches long,  $\frac{1}{2}$ — $\frac{3}{4}$  inch broad.

*Flowers*:—March and December (Schweinf.).

*Locality*:—Shum Shum Range, upper Wadi Maala (Schweinf.); ravine south-west of the Tower of Silence (Defl.); without locality (Birdw.).

*Distribution*:—Yemen, Eritrea, highlands of Somaliland, Kordofan, Abyssinia, Nubia, Togo.

**7. *Acacia læta*** R. Br.; Benth. in Hook. Lond. Journ. Bot. 1842, 508; Schweinf. Acacien Arten d. Nilgeb. 367, t. 19, 20, 21; Reliq. Kotschyanae, t. 1, 2; Oliv. Fl. trop. Afr. II, 34.

*Description*.—A small or moderate-sized tree. Extremities brown, smooth, with short black and shining hooked infra-stipular prickles, or wholly unarmed. Leaves glaucous, scarcely exceeding 2—3 inches in length; pinnæ lax in 2—3 pairs; leaflets oblanceolate-or obovate-oblong, oblique, obtuse, often mucronulate, subsessile, in 3—5 pairs,  $\frac{1}{4}$ — $\frac{1}{2}$  inch long,  $1\frac{1}{2}$ —2 lines broad above.

Spikes axillary, solitary or fascicled, equalling or exceeding the leaves. Flowers subsessile. Calyx broadly and shortly toothed. Petals at least at first united about  $\frac{2}{3}$  their length. Ovary glabrous, shortly stipitate.

Legume flat, oblong, often once or twice constricted owing to abortion of seeds, obtuse or pointed; valves thinly coriaceous, transversely reticulate, glabrous, shortly stipitate, 2—3 inches long,  $\frac{3}{4}$ —1 inch broad.

*Locality*.—Aden (Defl., Schweinf.).

*Distribution*.—Abyssinia, Nubia.

The following species are cultivated in Aden and its immediate neighbourhood:

**S. *Acacia arabica*** (Forsk.) Willd. Sp. Pl. IV, 1085; DC. Prodr. II, 461; Hook. Fl. Brit. Ind. II, 293; Benth. Lond. Journ. Bot. I, 500 et Trans. Linn. Soc. XXX, 506; Schweinf. Linnæa XXXV, 335; Oliv. Fl. trop. Afr. II, 350.

*Mimosa arabica* Lam.; Roxb. Cor. Pl. t. 149.

*Mimosa nilotica* Forsk. Fl. Aeg.-Arab. p. LXXVII.

*Acacia vera* Willd. Sp. Pl. IV. 1056.

*Arabic names*.—Quaradd, sselm, sselam.

*Description*.—A large tree; bark rough with deep narrow longitudinal fissures; heart-wood pale red, when fresh cut nearly colourless, on exposure turning reddish-brown. Stipular spines straight,  $\frac{1}{2}$ —2 inches long. Pinnæ 3—6 pair, cup-shaped glands at the base of the lowest, and generally also of the uppermost pair. Leaflets small, linear, 10—20 pair

Flowers golden-yellow, in globose heads,  $\frac{1}{2}$  inch in diameter; peduncles slender, fasciculate; a pair of scaly bracts in the middle.

Pod solitary, moniliform, much contracted between seeds at both sutures, whitish-tomentose; stalk  $\frac{1}{2}$ — $\frac{3}{4}$  inch long.

Schweinfurth says that the Aden plant is the 'Indian form' with pods very much or only slightly constricted between the seeds. It is, nevertheless, quite probable that the seeds originally came from Arabia; but there is no reason for asserting that *A. arabica* is indigenous in Aden.

*Flowers*.—Aug. 1898 (Birdw.).

*Fruits* —March (Schweinf.).

*Locality*.—Near the tanks (Schweinf.); Shum Shum Range (Ellenbeck); without locality (Birdw.).

*Distribution*.—Ceylon, Northern Deccan, Sind, S. Persia, Central and S. Arabia, Kordofan, Abyssinia, Libya, Nubia, Syria, Egypt, Algeria, Morocco, Togo, Senegal.

*Note*.—This tree was very common in Egypt in Pharaonic times, growing spontaneously and being cultivated at the same time.<sup>1</sup> It is mentioned among the plants of 24 out of 42 sacred groves. Strabo speaks of an acacia-wood in the neighbourhood of a sanctuary of Acanthos in Libya.<sup>2</sup> Fragments of this tree have frequently been found in the Pharaonic tombs. Flinders Petrie discovered different utensils made of acacia-wood in the necropolis of Kahun.<sup>3</sup> Some of the garlands which adorned the mummies of Ahmes I and Ahmenhotpu I consisted of acacia-flowers.<sup>4</sup>

The tree is often mentioned in Egyptian texts. It was called 'shent' in the hieroglyphic language ('shett' in Hebrew, 'sant' in Aramaic, 'shonte' or 'shanti' in Coptic) which probably means 'thorn'.<sup>5</sup> Even the Arabs of our days call it 'sunt.' The Greeks named it 'acantha'<sup>6</sup> or 'acacia,' whilst to the Romans<sup>7</sup> it was known under the names of 'acanthus' or 'spina ægyptiaca.' The Greek 'kommi' and the Latin 'gummi' were probably derived from the Egyptian 'kami' (also 'kemai' and 'kema') which was the name for the gum of the acacia.<sup>8</sup>

**9. Acacia Farnesiana** Willd. Sp. Pl. IV (1805), p. 1083; Hook. Fl. Br. Ind. II, 292; Aitch. Pb. and Sind Pl. p. 54.

*Vachellia Farnesiana* Wight et Arn. Prodr. p. 272; Grah. Cat. p. 58.

*Name*.—Known in Europe as the Cassia Flower.

*Description*.—A shrub or low tree; branches slender, zigzag, marked with grey or pale-brown dots; stipular spines only. Leaves 2-pinnate, 1—2 inches long; main rhachis more or less pubescent; petioles usually furnished with a minute gland about the middle; stipules spinescent,

<sup>1</sup> Moldenke, C. E. Ueber die in altägyptischen Texten erwähnten Bäume und deren Verwerthung. Leipzig, 1887, p. 74—81.

<sup>2</sup> Dahshour. Geographica. Lib. XVIII, cap. 1, 35.

<sup>3</sup> Flinders Petrie. Kahun, Gurob and Hawara, p. 50, 1.

<sup>4</sup> Schweinfurth, G. Ueber Pflanzenreste. Ber. d. bot. Ges. vol. 2 (1884), p. 363.

<sup>5</sup> Loret, V. La Flore pharaonique, d'après les documents hiéroglyphiques. 2nd. ed. Paris, 1892, p. 84, no. 142.

<sup>6</sup> Theophrastus. Historia Plantarum, lib. IV, c. 2, 8.

<sup>7</sup> Plinius. Historia naturalis, lib. XIII, 9 (19), ed. Teubner, Vol. II, p. 327.

<sup>8</sup> Wiedemann, A. Sammlung altägyptischer Wörter, welche von klassischen Autoren umschrieben oder übersetzt worden sind. Leipzig, 1883, p. 26.

$\frac{1}{6}$ — $\frac{1}{3}$  inch long, hard and sharp, divaricate ; pinnae 4—8 pairs,  $\frac{3}{4}$ —1 inch long. Leaflets 10—20 pairs,  $\frac{3}{16}$ — $\frac{1}{4}$  by  $\frac{1}{20}$ — $\frac{1}{16}$  inch, sessile, rigidly coriaceous, linear-oblong, acute, green, subglabrous, base oblique, rounded.

Flowers in globose heads,  $\frac{1}{4}$ — $\frac{1}{3}$  inch in diameter, fragrant, deep yellow ; peduncles  $\frac{3}{4}$ —1 inch long, crowded on axillary nodes, slender, terete, pubescent, with a ring of small deflexed ciliate bracts at or near the apex ; bracteole solitary, deltoid, on a long slender stalk, ciliolate. Calyx  $\frac{1}{16}$  inch long, membranous, teeth short, triangular, acute. Corolla  $\frac{1}{16}$  inch long ; lobes very short ; obtuse. Ovary glabrous.

Pods 2— $3\frac{1}{2}$  by  $\frac{1}{2}$  inch, subcylindric, turgid, slightly curved, conspicuously striately veined, glabrous, brown ; mesocarp pulpy. Seeds biseriate.

*Locality* :—Cultivated at Shaikh O'thman (Defl.).

*Distribution* :—Indigenous in America, but naturalized in India, Burma and other countries.

## 2. *Prosopis* Linn.

Erect prickly trees or shrubs. Leaves 2-pinnate ; stipules small or 0. Leaflets small, narrow.

Flowers 5-merous, usually sessile, in narrow spikes or subspicate racemes. Calyx campanulate, shortly toothed or subentire. Petals connate below the middle or at length free, valvate. Stamens 10, free, shortly exserted ; anthers crested with a deciduous gland. Ovary sessile or stalked ; ovules many ; style filiform ; stigma minute, terminal.

Pod turgid, cylindric or oblong, straight, falcate, or variously twisted, septate between the seeds ; mesocarp thick, spongy. Seeds usually ovoid, compressed.

*Species* about 18.

*Distribution* :—Tropical and subtropical regions of the world.

The following species is cultivated near the tanks of Aden :

**1. *Prosopis juliflora* DC.** Prodr. II, 447 ; Benth. in Trans. Linn. Soc. vol. 30, 337.

*Prosopis glandulosa* Torrey Ann. N. Y. Lyc. II, 192, t. 2.

*Algarobia glandulosa* Torr. & Gray Fl. I, 399 ; Gray, Pl. Wright, I, 60.

*Prosopis odorata* Torr. in Frem. Rep. 313, t. 1, excl. fruct.

*Description* :—A shrub or tree, glabrous or puberulent, with stout axillary spines, or often unarmed. Leaflets 6—30 pairs, short-oblong to linear, 3—18 inches long, obtuse or acute.

Spikes shortly peduncled, 2—4 inches long, usually dense, 1—3-fruited. Flowers nearly sessile, a line long.

Pod 4—6 inches long or more, straight or curved, at first flat and constricted between the seeds, 3—6 lines broad, at length sweet and pulpy within, acuminate, longitudinally veined; stipe 3—6 lines long.

*Distribution*:—Tropical America.

*Note*:—*Prosopis juliflora* DC. is the Algaroba of the Mexicans or Honey Mesquit, found as a small shrub in South-eastern California and eastward to Texas. It extends in various forms southward through Mexico, and along the Andes to Chili, and to Buenos Ayres.

The abundant fruit is eaten by the Indians and often by whites, and is a valuable food for horses. The shrub also furnishes a valuable gum, resembling Gum Arabic, which in Texas and Mexico is collected in considerable quantity for export.

### 3. *Calliandra* Benth.

Shrubs or trees. Leaves bipinnate, with small or large leaflets.

Flowers in globose heads, polygamous, 5-merous. Calyx campanulate, toothed. Corolla funnel-shaped, deeply 5-cleft. Stamens indefinite, monadelphous at the base; filaments filiform, much exerted; anthers minute, not gland-crested. Ovary stalked, many-ovuled; style filiform; stigma minute, capitate.

Pod strap-shaped, slightly falcate, flat, rigidly coriaceous, the valves dehiscing with elasticity, bordered by much-thickened sutures, continuous within, narrowed gradually to a short stalk.

*Species* about 80.

*Distribution*:—Mostly tropical American.

The following species is cultivated at Shaikh O'thman according to Defflers:—

1. *Calliandra umbrosa* Benth. in Gen. Pl. I, 597; Hook. Fl. Brit. Ind. II, 302.

*Inga umbrosa* Wall. Pl. As. Rar. t. 124; Cat. 5273.

*Albizia umbrosa* Benth. in Hook. Lond. Journ. III, 86.

*Description*:—A tree 20—25 feet high with slender glabrous branches and sometimes with small suberect stipular spines. Leaves 2-pinnate, petiole  $1\frac{1}{4}$  inches long, glabrous; pinnae 2, terminal, each with rhachis  $1\frac{1}{4}$ — $1\frac{1}{2}$  inches long, with a pair of large, sessile, oblique, oblong, rigidly subcoriaceous end-leaflets, acute at apex, cuneate at base, 6 inches long, 2 inches wide and with an odd similar but much smaller leaflet  $1\frac{1}{2}$ —2 inches long,  $\frac{1}{2}$ — $\frac{3}{4}$  inch wide, on the outer side below; leaflets all glabrous on both sides, rather distinctly nerved beneath and each with a gland on rhachis at base.

Flowers sessile in small dense globose heads  $\frac{2}{5}$  inch across, with minute bracts, on short ascending slender peduncles  $\frac{2}{5}$ — $\frac{1}{2}$  inch long, usually several together from old nodes on the branches; elongating in fruit to  $1\frac{1}{2}$ —2 inches. Calyx campanulate, teeth valvate. Corolla  $\frac{1}{8}$  inch long, yellow, inodorous.

Pod 6—9 inches long,  $\frac{3}{4}$ —1 inch wide, smooth, finely veined, the valves with elevated rounded thickened edges. Seeds 6—9, ovate,  $\frac{1}{2}$  inch long,  $\frac{7}{10}$  inch wide, long diameter transverse, very much compressed; testa smooth, shining, thin, crustaceous, brown.

*Distribution* :—Penang.

### XIX.—COMBRETACEÆ.

Trees or shrubs; leaves simple, entire; without stipules.

Flowers bracteate, usually sessile, bisexual, rarely polygamous, regular with a zygomorphic tendency. Calyx-tube adnate to ovary and produced beyond it, free portion 4—5-cleft; segments valvate. Petals wanting, or small, inserted on the edge of the calyx-tube between its segments. Stamens as many as calyx-segments or twice their number, inserted inside the calyx; anthers dehiscing longitudinally. Ovary inferior, 1-celled, ovules 2—5, rarely more, on large funicles, pendulous from the apex of the cell.

Fruit generally angled or winged; seed 1, without albumen. Embryo straight; radicle superior; cotyledons oily, generally convolute.

*Genera* 15. *Species* about 320.

*Distribution* :—Tropics of the whole world; outside the tropics in S. Africa.

#### 1. *Terminalia* Linn.

Trees. Leaves alternate or subopposite, frequently crowded at the ends of the branches, often with glands on the petiole or at the base of the midrib beneath.

Flowers green or white, rarely coloured, small, spicate, hermaphrodite or often the upper flowers on the spikes male and the lower hermaphrodite. Calyx-tube ovoid or cylindric, constricted above the ovary; limb of 5 short valvate triangular lobes, soon deciduous. Petals 0. Stamens 10, inserted on the calyx-lobes, biseriate, the 5 lower opposite the calyx-teeth, the 5 upper longer and alternate with the calyx-teeth; filaments subulate or filiform, exserted. Ovary inferior, 1-celled; ovules 2—3, pendulous from the apex of the cell; style subulate, often thickened and villous at the base; stigma simple.



Fruit ovoid, various in size and texture, smooth or angular or 2-5-winged, indehiscent, coriaceous. Seed solitary, exalbuminous; cotyledons convolute.

*Species* about 135.

*Distribution* :—Tropics of both worlds.

**1. *Terminalia* sp.** ex Krause in Engl. Bot. Jahrb. XXXV, Heft 5, p. 47.

*Locality* :—Rocky slope of the Shum Shum Range (Ellenbeck).

"This *Terminalia*, which has been collected by Ellenbeck only and of which we have only a poor specimen, seems to be nearly allied to, and perhaps identical with, *T. Kelleri* Engl. et Diels of Somaliland." Krause.

## XX.—LYTHRACEÆ.

Trees, shrubs, or herbs; branches often 4-gonous, leaves entire, usually opposite, sometimes alternate or whorled; stipules 0.

Flowers hermaphrodite, usually regular, cymose or paniculate. Calyx usually free, persistent; primary teeth or lobes 3—6, with sometimes as many accessory teeth added, valvate. Petals as many as the primary teeth of the calyx, rarely fewer or 0. Stamens definite or indefinite, inserted at various heights on the calyx-tube. Ovary superior (rarely inferior), 1—6-celled; ovules many, placentas axile, rarely parietal; style usually filiform; stigma capitate, rarely 2-lobed.

Fruit capsular or baccate, membranous or coriaceous, girt round the base by the calyx or entirely included in it, or rarely surmounted by it, 2—6-celled or, by the imperfection of the partitions, 1-celled, variously dehiscent, rarely indehiscent. Seeds numerous, sometimes winged; albumen 0; embryo usually straight; cotyledons usually oblong or orbicular, flat, 2-auricled at the base and with a short radicle.

*Genera* 30; *species* about 280.

*Distribution* :—Chiefly tropical.

### 1. *Lawsonia* Linn.

A glabrous shrub; younger branches sometimes 4-gonous, the older terete, often spinescent. Leaves opposite, shortly petiolate, ovate-lanceolate, entire.

Flowers in terminal paniced cymes. Calyx-tube short; lobes 4, spreading, broadly ovate; accessory teeth 0. Petals 4, very shortly clawed, inserted at the base of the calyx-tube in pairs opposite to calyx-lobes; anthers broadly oblong, the connective thick. Ovary

subglobose, 2—4-celled; ovules many, placentas axile; style thick, slightly longer than the stamens; stigma capitate.

Capsule globose, stalked in the base of the calyx-tube, coriaceous, irregularly breaking up, ultimately 1-celled. Seeds closely packed on a central placenta, angular, pyramidal.

*Species* 1.

*Distribution* :—Not exactly known; probably indigenous in N. and E. Africa, Arabia, Persia, the drier parts of the Peninsula of India and Ceylon; cultivated in many tropical and subtropical countries.

**1. *Lawsonia inermis*** Linn. Sp. Pl. ed. 1 (1753) 349; Bedd. Fl. Sylv. 118, t. 14, f. 6; Blanco Fl. Filip. ed. Manila II (1878) 21, t. 108; Koehne in Engl. Bot. Jahrb. IV (1883) 36; in Engl. & Prant. Pflanzenfam. III, 7 (1891) 15, f. 6; in Engl. Pflanzenreich IV, 270; Cook Fl. Bomb. Pres. I, 511.

*Lawsonia spinosa* Linn. Sp. Pl. ed. 1 (1753) 349 (non Lour.).

*Lawsonia alba* Lam. Enc. III (1789) 106; DC. Prodr. III (1828) 91; Wight Ill. I (1840) 207, t. 87; Grah. Cat. Bomb. Pl. 67; Dalz. & Gibs. 97; Hook. Fl. Brit. Ind. II, 573; Trim. Fl. Ceyl. II, 228; Brandis Ind. Trees 340; Baill. Hist. Pl. VI (1877) 433 f. 407—409.

*Alcanna spinosa* Gaertn. Fruct. II (1791) 133, t. 110.

*Casearia multiflora* Spreng. Pugill. II (1815) 116 (non Jacq.).

*Rotantha combretoides* Bak. in Journ. Linn. Soc. XXV (1890) 317.

Mail Anschi Rheede Hort. Malab. I (1678) 73, t. 40.

*Cyprus* s. *Alcanna* Rumph Herb. Amb. IV (1750) 42, t. 17.

*Arabic name* :—Henneh, Alhenna.

*English Name* :—Egyptian Privet.

*Description* :—A glabrous much branched shrub; lateral branches 4-gonous, often ending in a spinous point. Leaves  $\frac{1}{2}$ — $1\frac{1}{4}$  by  $\frac{1}{4}$ — $\frac{5}{8}$  inch, elliptic or broadly lanceolate, acute or obtuse, often mucronulate, base tapering; petioles very short or 0.

Flowers numerous, less than  $\frac{1}{2}$  inch across, fragrant, white or rose-coloured, in large terminal pyramidal paniced cymes; pedicels short, slender. Calyx  $\frac{1}{8}$ — $\frac{1}{5}$  inch long, broadly campanulate; lobes  $\frac{1}{10}$ — $\frac{1}{8}$  inch long, ovate, acute. Petals  $\frac{1}{8}$  inch long, as broad as long, suborbicular or subreniform, undulate. Stamens 8, inserted in pairs on the calyx-tube.

Capsule  $\frac{1}{4}$  inch in diameter, globose, slightly veined outside, supported by the persistent calyx and tipped with the style. Seeds trigono-pyramidal, about  $\frac{1}{10}$  inch long, externally subtuberculate.

*Locality* :—Shaikh O'thman (Ellenbeck, Busse, ex Krause).

*Uses and History:*—From the leaves the well-known dye, called 'henna,' is obtained. For this purpose the leaves are dried, sifted, a little sarson oil added and then reduced to a powder. It is occasionally used in dyeing cloth, but the principal value is as an article of the toilet, for staining the finger-nails, hands and feet a dull orange colour, also for dyeing the hair into a bright red colour. This is often but a first stage in the production of black by the action of indigo on the original red. The use of henna as a cosmetic dates from very ancient times, and is universal among Muhammadan women. The seeds yield an oil, about which little is known, and the flowers are employed in perfumery and embalming. (Watt.)

The Hebrew name of the henna is 'kopher.' In the hieroglyphic language the flower is called 'puqer'. In Coptic the shrub bears the name 'khuper' or 'kuper'. Even in demotic textes we already find the name 'kapra.' There is evidently some relationship between the Hebrew and Egyptian names; but it is doubtful whether the Israelites have borrowed the name in the valley of the Nile, or whether the Egyptians received the plant with its name from the East. Archæologists could not find the product before the Rameses dynasty, and the name itself occurs only in the Ptolemaic inscriptions.<sup>1</sup> From the dried leaves the Egyptians prepared an orange-red powder which they employed as a dye for the hands, feet, and nails, not only of living persons, but also of mummies. Fragments of leaves and powder of *Lawsonia* have, besides, been discovered in Egyptian tombs. According to Dioscorides and Pliny the Egyptians diluted the powder with the juice of *Saponaria* (soap-wort) and used it as a dye for the hair.<sup>2</sup> Henna entered also into the composition of the famous perfume, called 'kyphi,' which consisted of 16 different ingredients.<sup>3</sup>

Pliny says that the best kind of henna grows on the banks of the Nile; the second best at 'Ascalon of Judea'; the third, and most sweet in odour, in 'Cyprus,' from which its Greek name 'cypros' was derived.

<sup>1</sup> Loret, V. *La flore pharaonique*, 2nd ed. Paris, 1892, page 80.

<sup>2</sup> Dioscorides. *De mat. med.* I, 124.

Plinius. *Historia nat.* XXIII, 46.

<sup>3</sup> Theophrastus. *Iib. de odoribus*, 195.

Plinius. *l. c.* XIII, 51.

Prosper Alpinus. *De plantis Aegypti*, XIII.

Celsius. *Hierobotanicon*, vol. I, 122.

Plutarchus. *De Iside et Osiride*. Cap. 80.

Dümichen. *Der Grabpalast des Patnamenap*, pp. 20—25.

Loret, V. *Le kyphi, parfum sacré des anciens Egyptiens*. Paris, 1887.

Loret, V. *La flore pharaonique*, pages 80—81.

Loret, C. *Les plantes dans l'antiquité*. Paris, 1897, Volume I, pages 318—320.

The plant is only twice mentioned in the Bible. The 'Song of Solomon' compares the spouse to 'a cluster of cyprus in the vineyards of Engaddi' (Cant. I, 13), and addresses her with these words: "Thy plants are a paradise of pomegranates with the fruits of the orchard, with cyprus and spikenard (Cant. IV, 13).

E. W. Lane gives an interesting description of the use of henna in Egypt: "The females of the higher and middle classes, and many of the poorer women, stain certain parts of their hands and feet (which are, with very few exceptions, beautifully formed) with the leaves of the henna-tree, which impart a yellowish-red, or deep-orange colour. Many thus dye only the nails of the fingers and toes; others extend the dye as high as the first joint of each finger and toe; some also make a stripe along the next row of joints; and there are several other principal modes of applying the henna; but the most common practice is to dye the tips of the fingers and toes as high as the first joint, and the whole of the inside of the hand and the sole of the foot; adding, though not always, the stripe above mentioned along the middle joints of the fingers, and a similar stripe a little above the toes. The henna is prepared for this use merely by being powdered, and mixed with a little water, so as to form a paste. Some of this paste being spread in the palm of the hand, and on other parts of it which are to be dyed, and the fingers being doubled, and their extremities inserted into the paste in the palm, the whole hand is tightly bound with linen, and remains thus during the whole night. In a similar manner it is applied to the feet. The colour does not disappear until after many days: it is generally renewed after about a fortnight or three weeks. This custom prevails not only in Egypt, but in several other countries of the East, which are supplied with henna from the banks of the Nile. To the nails, the henna imparts a more bright, clear, and permanent colour than to the skin. When this dye alone is applied to the nails, or to a larger portion of the fingers and toes, it may, with some reason, be regarded as an embellishment; for it makes the general complexion of the hand and foot appear more delicate; but many ladies stain their hands in a manner much less agreeable to our taste: by applying, immediately after the removal of the paste of henna, another paste composed of quicklime, common smoke-black, and linseed-oil, they convert the tint of the henna to a black, or to a blackish-olive hue. Ladies in Egypt are often seen with their nails stained with this colour, or with their fingers of the same dark hue from the extremity to the first joint, red from the first to the second joint, and of the former colour from the second to the third joint; with the palm also stained in a similar manner, having a broad, dark stripe across the middle, and the rest left red; the thumb dark from the

extremity to the first joint, and red from the first to the second joint. Some after a more simple fashion, blacken the ends of the fingers and the whole of the inside of the hand.<sup>1</sup>

## XXI.—LOASACEÆ.

Bristly undershrubs or (climbing) herbs.

Flowers in cymes, regular, dichlamydeous, hermaphrodite. Flower-tube adnate to the ovary, 10-ribbed; limb 5-lobed; lobes persistent. Petals 10, in two rows, perigynous. Stamens indefinite, arranged in 5 bundles; anthers 2-celled, introrse, opening longitudinally; staminodes petaloid or none. Ovary inferior, 3-celled, free at the apex; style filiform. Ovules solitary in each cell of the ovary (in the African-Arabian species), anatropal, pendulous from the apex of the cavity.

Fruit dry, 1—3-celled, 1—3-seeded. Seed exalbuminous; embryo straight; radicle superior; cotyledons flat, thick.

*Genera* 13. *Species* about 200.

*Distribution*.—All of tropical and subtropical America, except the monotypic genus *Kissenia*.

### 1. *Kissenia* R. Br.

An undershrub, covered with rough bristles. Leaves exstipulate, alternate, stalked, irregularly pinnately lobed.

Flowers in terminal leafy cymes. Flower-tube bristly, 10-ribbed; limb 5-parted; lobes leafy, oblong, persistent, and enlarged in fruit. Petals 10, deciduous, attached in two rows to the throat of the flower-tube, 5 outer alternate with the sepals, roundish or obovate, concave, slightly keeled at the back; 5 inner smaller, opposite to the sepals, linear-oblong, bent in the middle. Stamens numerous, 65—75 fertile in five phalanges, inserted with the petals; filaments thread-like; anthers didymous. Ovary inferior, 3-celled. Ovules 1 in each cell, pendulous from the apex. Style filiform, spirally twisted near the top.

Fruit bristly, 10-ribbed, surmounted by the persistent calyx-lobes, 2—3-celled with fibrous partitions. Seed solitary in each compartment, compressed or slightly convex on both surfaces; testa membranous, veined, rough; embryo straight; cotyledons leafy, thick; radicle very short, superior.

*Species* 1.

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<sup>1</sup> Lane, E. W. The Manners and Customs of the Modern Egyptians. London, Dent & Co., pp. 39—40.

1. *Kissenia spathulata* R. Br. in Herb. Mus. Brit.; Anders. Journ. Linn. Soc. V, Suppl. p. 43; Oliv. Fl. trop. Afr. II, 501.

*Fissenia capensis* Endl. Gen. Pl. Suppl. II, 76 (*sine descript.*); Harv. Thes. Cap. t. 98.

*Cnidone Mentzeloides* E. Mey. in Herb. Drège, et Presl Bot. Bemerk. p. 73.

*Description*:—A half-woody shrub, 4—5 feet high; stem erect, striate, scabrous-papillose; cortex pale. Leaves alternate, petiolate, 2 inches long,  $1-1\frac{1}{2}$  inches broad, the lower ones 3—7-lobed, the upper ones linear-lanceolate, bracteiform, acute, sinuate-dentate, rough on both sides; petiole  $\frac{1}{2}$  inch long, terete, striate, dilatate at the base, prolonged into a prominent nerve.

Calyx accrescent; tube ovate, in fruit  $1\frac{1}{2}$  inches long, 10-costate, ribs fulvous-pilose; limb 5-partite; lobes long-spathulate, subherbaceous, 3-nerved, reticulately nervate, scabrous. Corolla half as long as the calyx-lobes, stramineous; petals 10, biseriate, the 5 larger ones alternate with the calyx-lobes, carinate, ovate, concave, the smaller ones opposite the calyx-lobes, ligulate, angular-incurved. Styles 3, short.

Fruit woody, 3-locular, often monospermic by abortion, crowned by 5 membranous wings of the persistent accrescent calyx.

*Flowers*:—April 1861 (Thomson), April 1878 (Perry), November (Schweinf.), December 1889 (Defl.).

*Locality*:—Plain of Maala (Schweinf., Defl.); gravelly slope of Shum Shum Range (Ellenbeck); Goldmore Valley (Lunt); common on northern slopes (Perry); without locality (Courbon, Thomson, Birdw.).

"The *Kissenia* is quite abundant in two or three places in Aden. Notably on the slopes stretching from the road leading to the cutting through which the road passes to the town of Aden from Steamer Point. It also grows on Steamer Point. I am told that often two or three years pass without this plant being seen at all. The present year 1878 follows a rainy season which is exceptional." Perry in folio Herb. Kew.

*Distribution*:—Yemen, Hadramaut, Somaliland, Namaland, Damara-land.

*Note*:—Anderson gives an explanation of how the original '*Kissenia*' became to be known under the name of '*Fissenia*' :

"Since the printing of this Florula," he says, "I have seen a specimen of a *Fissenia*, collected at Aden by Dr. Courbon, of the French exploring expedition under the command of Captain Russel, and kindly communicated to Dr. Hooker for my inspection by Prof. Brongniart of Paris. This is the plant upon which Brown founded the genus and

of which I have examined his original specimen in the British Museum : it does not, however, bear the name *Fissenia*, but *Kissenia*, in honour of its discoverer, M. Kissen, a traveller in Arabia. Endlicher, who is responsible for the spelling *Fissenia*, probably obtained the generic name for the South African species, orally, from R. Brown." (Florula Adenensis, p. 42.)

## XXII.—CUCURBITACEÆ.

Usually climbing perennial-rooted herbs. Leaves alternate, simple or compound, exstipulate ; tendrils lateral, solitary, simple or 2—8-fid.

Inflorescence various, axillary. Flowers unisexual. Calyx-tube adnate to the ovary ; lobes 5, rarely 3 or 6, imbricate. Petals 5, rarely 3 or 6, free or connate, often confluent with the calyx-tube.

Anthers extrorse, free or connate, simple or 2—3-fid ; cells straight, curved, conduplicate or contorted ; connective sometimes produced beyond the cells. Ovary inferior or rarely free at the apex only, usually 3-carpellary ; ovules usually many and horizontal in most genera.

Fruit usually a succulent or hard indehiscent many-seeded berry, rarely dehiscing by valves or bursting irregularly. Seeds of various forms, often imbedded in pulp or fibre ; testa coriaceous or crustaceous ; no albumen.

*Species* about 600.

*Distribution* :—Warmer parts of the globe, especially in the Tropics.

Corolla 5-partite to the base or 5-petalous.

Connective produced beyond the cells . . . . 1. *Cucumis*.

Connective not produced beyond the cells . . . . 2. *Citrullus*.

Corolla campanulate, divided to the middle or a little below it. 3. *Corallocarpus*.

### 1. *Cucumis* L.

Annual herbs with a perennial root, climbing or trailing, hispid or scabrid. Leaves entire, lobed, palmate or pedate. Tendrils simple, sometimes spinescent.

Flowers yellow, usually monœcious. Male flowers : Fascicled or solitary. Calyx-tube short, subulate. Corolla subcampanulate, deeply 5-lobed or -partite. Stamens 3, free ; filaments short ; anthers free, oblong, one 1-celled, two 2-celled ; cells various ; connective produced into a papillose appendage. Rudiment of ovary glandular. Female flowers : Solitary. Staminodes 0 or subulate or reduced to glands. Calyx and corolla as in the male. Ovary ovoid or globose ; ovules  $\infty$ , on 3 or 5 placentas ; style short ; stigmas 3, obtuse.

Fruit fleshy or corky, globose or cylindric, terete or obtusely angled, smooth or echinate, or 3-valved. Seeds many, oblong, compressed.

*Species* about 26.

*Distribution* :—Tropical Asia and Africa, a few in Australia and America.

Fruit striped, 1—1½ inches long, with soft, slender spines . . . *C. prophetarum*.

Fruit 1½—3½ inches long, with distant stout spines . . . *C. pustulatus*.

**1. *Cucumis prophetarum* L.** Sp. Pl. ed. I, 32 ; D C. Prodr. II, 301 ; Boiss. Fl. Or. II, 758 ; Naud. in Ann. Sc. Nat. ser. IV, XI, 14 ; Anders. Journ. Linn. Soc. V, Suppl. p. 19 ; Hook. Fl. Brit. Ind. II, 619.

*Cucumis arabicus* Del. in Cat. Hort. Monsp.

*Cucumis anguinus* Forsk. Fl. Aeg.-Arab. p. 168.

*Cucumis amarus* Stocks in Herb. Hook.

*Description* :—Annual, monœcious. Stems slender, branched, angled and grooved, scabrid. Tendrils striate, sometimes absent. Leaves polymorphous, rigid, ¾—2 inches long and broad, scabrid on both surfaces, subtriangular-reniform or palmately 3—5-lobed ; lobes short or long, quite entire or dentate, obtuse or acute, base truncate or more or less deeply cordate.

Male flowers solitary or fascicled ; peduncles filiform, densely hairy. Calyx and corolla hispid. Connective produced into a linear, flat, simple or 2-fid appendage, glandular at the top. Female flowers : Peduncle stout, ½—1 inch long, covered with rigid prickles. Staminodes linear.

Fruit subglobose, 1—1½ inches long, green with pale vertical bands, covered with scattered, soft, slender spines. Seeds small, ⅞ inch long, elliptic-oblong, smooth ; pulp bitter.

*Flowers* :—March 1878 (Perry), December 1847 (Hooker).

*Fruits* :—February 1851 (Thomson), November (Schweinf.).

*Locality* :—Plain of Maala (Deff.) ; Goldmore Valley, near the coal depôts of the Messag. Marit. (Schweinf.) ; slope of Shum Shum Range (Ellenbeck) ; great valley between Steamer Point and Town (Marchesetti) ; in sandy places (Hook., Thomson, Anders.) ; Steamer Point (Lunt) ; without locality (Birdw., Perry, Balfour).

*Distribution* :—Sinai, Egypt, Nubia, Abyssinia, Kordofan, Arabia, Socotra, Baluchistan, Sind.

**2. *Cucumis pustulatus* Hook.** in Oliv. Fl. Trop. Afr. II, 544 ; Cogn. in DC. Monogr. Phan. III, 495.

*Cucumis abyssinicus* Schimp. Herb. Abyss. No. 412.

*Arabic name* :—Hamak-el-hhomr.



*Description* :—Perennial, hoary and scabrid. Stem rather stout, angled, rigid, beset with short white prickles. Leaves  $\frac{1}{2}$ —2 inches in diameter, coriaceous, very variable, oblong, rounded or cordate, subentire or more or less deeply 3—5-lobed, lobes obtuse, quite entire or toothed, petioles rather short. Tendrils short, rather rigid.

Male flowers: Calyx campanulate, shortly scabrid. Connective shortly produced into a broad glandular appendage. Female flowers: Ovary covered with short stout prickles.

Fruit on very stout peduncles,  $1\frac{1}{2}$ —3 inches long, broadly ovoid, rounded at both ends, covered with scattered, thick, conical tubercles or spines. Seeds small,  $\frac{1}{8}$  inch, whitish, smooth, elliptic-oblong, without thickened border or depressed disk.

*Fruits* :—February (Thomson).

*Locality* :—Aden (Hooker, Thomson, Schweinf.).

*Distribution* :—Yemen, Eritrea, Highlands of Somaliland, Abyssinia.

*Note* :—J. D. Hooker, who collected *C. pustulatus* at Aden in 1847 and 1851, says that the fruit of the Aden specimen is scabrid as well as aculeate, which is not the case in others from Arabia Petraea.

## 2. *Citrullus* Schrader.

Perennial herbs, usually trailing. Tendrils 2—3-fid, rarely undivided. Leaves deeply 3—7-lobed, the lobes usually lobulate.

Flowers rather large, yellow, monœcious, solitary. Male flowers: Calyx-tube broadly campanulate; lobes 5. Corolla 5-partite beyond the middle, subcampanulate; segments oblong-ovate, obtuse. Stamens 3, filaments short, free; anthers scarcely cohering, one 1-celled, the others 2-celled, the cells linear, flexuose, the connectives not produced. Pollen smooth. Rudimentary ovary glanduliform. Female flowers: Calyx and corolla as in the male. Rudimentary stamens 3, setose or ligulate. Ovary ovoid, 3-placentiferous; ovules  $\infty$ , horizontal; style short; stigmas 3, thick, reniform.

Fruit globose or ellipsoid, smooth, fleshy, indehiscent. Seeds very many, much compressed, smooth.

*Species* 3.

*Distribution* :—Eastern Mediterranean region, Tropical Africa, Western Asia.

1. *Citrullus colocynthis* (L.) Schrad. in Linnæa XII, (1838), 414; Arn. in Hook. Lond. Journ. Bot. III, 276; Anders. Journ. Linn. Soc. V, Suppl. p. 20; Boiss. Fl. Or. II, 759; Naud. in Ann. Sc. Nat. ser. IV, XII, 99; Oliv. Fl. trop. Afr. II, 548; Batt. et Trab. Fl. d'Alg. p. 332.

*Cucumis colocynthis* L. Sp. Pl. ed. I, p. 1011; DC. Prodr. III, 302; Cogn. in DC. Monogr. Phan. III, 510.

*English name*:—Colocynth.

*Arabic name*:—Hándhal gehed; (dohn el-handhal = oil of C.).

*Description*:—A monœcious, root-perennial herb; stems diffuse or creeping, angled, hirsute or scabrid. Tendrils simple or bifid. Leaves triangular-ovate in outline, 2—4 inches long, 7-lobed, or 3-lobed with the middle lobe ovate, the lobes pinnatifid or sinuate-lobulate, very scabrid on both surfaces.

Male flowers: Peduncles villous. Calyx campanulate, hairy,  $\frac{1}{8}$  inch long; teeth lanceolate,  $\frac{1}{12}$  inch long. Corolla pale yellow, segments obovate, apiculate. Female flowers: Ovary ellipsoid, villous.

Fruit globose, slightly depressed, 2—3 inches in diameter, variegated green and yellow; pulp dry, intensely bitter. Seeds small, lenticular, smooth.

*Fruits*:—January 1863 (Oliver and Cl.).

*Locality*:—Goldmore Valley (Schweinf.); Ravine south-west of the Shum Shum R., sandy plain between Bir Achmed and Shaikh O'thman (Defl.); great valley between Steamer Point and town (Marchesetti); on the shore (Anders.); without locality (Birdw., Oliver and Cl., Kuntze).

*Distribution*:—Spain, Canaries, Cape Verd Islands, N. Africa, Arabia, Palestine, Sind, Punjab, Ceylon.

*Uses*:—The fruit is in size and shape much like an orange, marble-green on the surface and changing to yellow as it ripens. The intensely bitter taste of the pulp is due to an amorphous yellow glucoside, Colocynthin, which is found in it to the extent of about 0.6 per cent., but not in the seeds. The fruit is a drastic purgative, and is used both in Native and European medicine. The yield is about 110 lb. compound extract to 60 lb. dried fruit.

The seeds contain from 15—17 per cent. of a fixed oil which is said to make a useful illuminant.

For the London market the peeled fruit is imported chiefly from Smyrna, Trieste, France, Spain, and more rarely from Persia. The unpeeled fruit is brought from Mogador. (Watt).

“Every part of the plant, especially the fruit, is of a very bitter taste, and is, therefore, employed by the Bedouins as an anthelmintic. Goats and Ibexes are very fond of the leaves and young plants, but the fruit is only eaten by donkeys. The ripe dried fruit is thrown into the fire and charred. Of this the Bedouins make gunpowder, time-fuses, and tinder.” A. Kaiser in fol. Herb. Kew.

On the oil prepared from the ripe fruit and its uses, see Ibn el Beithar, vol. II, p. 127—128.

The same author says that the pulp of the fruit is called 'kebest' (vol. III, 143) and according to Abu Hanifa, the name of the seed is 'hebed' (eod. l. III, 387).

*Historical Note*.—The Colocynth seems to be the plant which is mentioned under the name 'pakkneth' in connection with an episode in the life of Eliseus. (IV, Reg. 4, 39). When Eliseus returned to Galgal, there was a famine in the land. One day he wanted to prepare a meal for his guests and for this purpose he sent a servant to gather some herbs. "And one went out into the field to gather wild herbs. And he found something like a wild vine, and gathered of it wild gourds of the field, and filled his mantle, and coming back he shred them into the pot of pottage, for he knew not what it was. And they poured it out for their companions to eat. And when they had tasted of the pottage, they cried out, saying: Death is in the pot, O man of Gcd. And they could not eat thereof."

The opinion that the Colocynth was the plant in question is strengthened by Rabbinical writers who state that the 'pakkneth' contained seeds which yielded an oil. To this may be added the fact, that the Colocynth, according to Tristram, grows most abundantly in the barren sands near Gilgal, and all around the Dead Sea in the low flats, covering the ground with its tendrils. The same author points out, that it was easy for an inhabitant of the highlands of Palestine to mistake this unfamiliar vegetable for one of the harmless kinds; and as it was a time of scarcity, he would be glad to appropriate any likely esculent.<sup>1</sup>

### 3. Corallocarpus Welw.

Prostrate or climbing, scabrid or subtomentose herbs. Leaves lobed or palmate. Tendrils simple, or absent.

Flowers minute, monœcious. Male flowers crowded at the end of a long peduncle. Calyx broadly campanulate, 5-lobed. Corolla 5-partite. Stamens 3, free, inserted on the calyx-tube; anthers entire or bipartite, one 1-celled, two 2-celled; connective produced or not, often bifid. Rudimentary ovary minute or absent. Female flowers sessile or shortly pedicelled, solitary or fascicled. Staminodes minute or absent.

<sup>1</sup> Cf. also:—Celsius. Hierobotanicon, vol. I, p. 397.

Tristram, H. B. The natural history of the Bible, London, 1889, p. 452.

Groser, W. H. The Trees and Plants mentioned in the Bible. London, 1895, p. 146.

Buxtorf. Lexicon chaldaicum, p. 891.

Calyx and corolla as in the male. Ovary ovoid, usually beaked 2—3-celled; ovules few on 2—3 placentas; stigma 3-, rarely 2—4-lobed.

Fruit a berry, fleshy, ovoid or ellipsoid, obtuse or beaked, operculately dehiscent near the base. Seeds few, tumid.

*Species* about 15.

*Distribution* :—India, Arabia, tropical Africa.

Male flowers forming axillary glomerules of 3—5 . . . 1. *C. glomeruliflorus*.

Male flowers not so :—

    Anthers sessile . . . . . 2. *C. erostris*.

    Anthers subsessile . . . . . 3. *C. velutinus*.

**1. *Corallocarpus glomeruliflorus*** Schweinf. Manusk. Sammlung arab.-æthiop. Pflanzen (ex Krause).

*Rhynhocarpa Courboni* Deff. in Bull. Soc. Bot. France XXXII, 349.

*Phialocarpus glomeruliflorus* Deff. in Bull. Soc. Bot. France XLII, 304.

*Corallocarpus Gijef* Schweinf. in Herb. Berol. (ex Krause).

*Description* :—An erect undershrub,  $\frac{2}{3}$ — $1\frac{1}{2}$  feet high, very scabrous; cortex green-succose on the inner side, at last papery, on the outer side suberose, white-cinereous, pulverulent; caudex succose, short, thick-clavate in the upper half, branching at the apex; branches spreading, rigid, sulcate, thickened at the base; branchlets shortened or slightly elongate, ecirrose, leafy, densely woolly at the axils of the leaves, the lower internodes covered with the hardened remains of the old petioles. Leaves green, velutinous-scabrous, orbicular, of various size, often  $\frac{2}{5}$ — $\frac{4}{5}$  inch long and  $\frac{3}{5}$ — $\frac{4}{5}$  inch broad, at the base deeply emarginate, sinuate-denticulate, subundulate; petiole as long as the lamina or slightly longer.

Flowers dioecious (?), greenish-yellow, minute, short-pedicelled. Male flowers forming axillary glomerules of 3—5; female flowers axillary, solitary, rarely geminate; pedicels erect, immersed in wool. Male calyx very small; tube globose-urceolate, hirsute, with the throat woolly-bearded; limb rotate; lobes linear-oblong, slightly acute, pubescent, as long as the corolla; corolla rotate, pubescent; limb 5-partite; segments ovate-lanceolate, obtuse. Stamens 3, opposite the petals, attached to the throat; filaments very short, complanate, glabrous; middle anther 1-locular, lateral ones 2-locular, hippocrepiform; loculi linear, arcuate, confluent at the apex; connective broad, obtuse. Female calyx acute than the male calyx; tube ventricose, adnate to the ovary, hirsute; limb campanulate, lobed scarcely to the middle; lobes deltoid-acuminate, acute, pubescent on the back, slightly longer than the corolla; corolla campanulate, as to the rest as in the male; ovary 2-placentiferous; style

columnar, very short, glabrous, no basilar disk; stigmas 2, orbicular, large, irregularly lobulate, deflexed; ovules 2—4, horizontal; placentæ tumid, pulpy.

Fruit (imperfectly ripe)  $\frac{1}{2}$ — $\frac{3}{8}$  inch long,  $\frac{1}{8}$ — $\frac{2}{8}$  inch broad, pubescent, ovate, attenuate into an oblique rostrum, longitudinally 10-costate from the rostrum to the fourth or fifth lower part; rostrum cylindrical, subarcuate; dehiscence doubtful, probably basilar. Seeds ovate-globose, subcompressed, black, minutely punctate, glabrous.

*Fruits*:—March (Schweinf.).

*Locality*:—On the Shum Shum Range (Defl.); Wadi Maala, above the coal depôt of the Messag. Marit., plateau below the top of the Shum Shum Range at a height of about 1,300 feet (Schweinf.); without locality (Beever, Hildebrandt); on the Jebel Muzulghum of Little Aden (Defl.).

*Distribution*:—Yemen.

*Note*:—Deflers says that this species attains its normal development only in the wooded valleys of the Jebel 'Areys (in Fodhli). In the neighbourhood of Aden, where the climate is extremely dry, only a very poor form is to be found, often leafless and sometimes with leaves much reduced. After the showers the leaf-buds develop very rapidly, but are soon arrested in their growth by the succeeding dryness.

**2. *Corallocarpus erostris* (Schweinf.) Oliv. Fl. trop. Afr. II, 567.**

*Rhynchocarpa erostris* Schweinf. in Verh. Zool. Bot. Ges. Wien 1868, p. 673.

*Description*:—Stem sparingly branched, angular, pruinose, sparsely hairy. Leaves orbicular, deeply sinuate-cordate, with 5 obtuse or rounded obscurely toothed angles, scabrous above, tomentose ashy scabrous below, nerves flattened. Tendrils woody pubescent.

Male flowers: Racemes very long, dense-flowered, ebracteate; pedicels puberulous, bracteolate in the middle. Corolla 5-lobed to the middle, yellow-green, three times as long as the calyx. Anthers sessile; cells oblong, obtuse, connate by the dilated connective. Female flowers: Racemes short, axillary, sessile, subfascicled, much smaller than the male.

Fruit ovoid, orange-yellow, glomerate, base constricted, apex acute or obscurely beaked, 4—6-seeded, resinous when dry. Seeds globose, somewhat compressed, yellow or brown, margined, marked with elevated lines.

*Locality*:—Valley on the south-western slope of the Shum Shum Range (Defl.); near the coal-depôt of the Messag. Marit. (Schweinf.).

*Distribution*:—Yemen, Eritrea, Nubia.

**3. *Corallocarpus velutinus* Benth. et Hook. f. Gen. Pl. I, 831.**

*Aechmandra velutina* Dalz. and Gibs. Bomb. Fl. p. 100.

*Description* :—A stout climbing herb ; root fibrous ; stems angular, hairy, deeply grooved, not much branched. Tendrils long, striate, simple. Leaves fleshy, suborbicular in outline, 2—3 inches long, pale-green and at first softly villous, finally scabrid above, tomentose and ashy grey beneath, cordate or subcordate at the base, deeply palmately 3—5-lobed ; lobes rounded or oblong, irregularly denticulate.

Male flowers in 15—20-flowered racemes ; peduncle 2—4 inches long. Calyx hairy ; teeth narrowly triangular ; corolla greenish-yellow ; segments ovate—oblong, subacute,  $\frac{1}{16}$  inch long. Anthers subsessile ; connective scarcely produced, bifid. Female flowers fascicled, subsessile.

Fruit including the beak  $\frac{3}{4}$  inch long, sessile, ellipsoid, red when ripe, finely velvety. Seeds  $\frac{1}{8}$  inch in diameter, globose.

*Fruits* :—March (Schweinf.).

*Locality* :—Aden (Birdwood, Schweinf.).

*Distribution* :—Tropical Africa, Sind.

### XXIII.—FICOIDEÆ.

Herbs or low shrubs. Leaves opposite, alternate or pseudo-verticillate, simple, often fleshy ; stipules none or scarious.

Flowers solitary or usually cymose. Petals usually wanting or small. Stamens perigynous or hypogynous, definite or indefinite ; filaments free or variously connate at the base. Disk 0 or annulate. Ovary usually free, 2—5-celled ; styles or stigmas as many as cells of ovary ; ovules solitary, few or  $\infty$ .

Fruit usually capsular, splitting dorsally or circumscissilely, or less commonly separating into cocci. Seeds solitary or numerous, usually reniform, compressed ; testa membranous or crustaceous ; embryo curved round farinaceous or fleshy albumen.

*Genera* 22 ; *species* about 450.

*Distribution* :—Tropical and sub-tropical regions.

Stamens inserted on the calyx-tube . . . . 1. *Trianthema*.

Stamens hypogynous.

Fruit capsular.

Petals many . . . . . 2. *Orygia*.

Petals 0 . . . . . 3. *Mollugo*.

Fruit of 2 one-seeded cocci . . . . 4. *Limeum*.

#### 1. *Trianthema* L.

Herbs or undershrubs, glabrous or papillose. Leaves opposite, unequal, entire, linear to rotundate ; petiole dilated with membranous stipuliform margins.

Flowers axillary, solitary, cymose or paniced. Calyx 5-fid, lobes with a dorsal subapical cusp. Petals none. Stamens 3—5—10 or  $\infty$ , inserted near the top of the calyx-tube. Ovary 1—2-celled, free, sessile, often truncate at the apex; ovules 1— $\infty$ , basal; styles 2 or 1.

Capsule membranous or coriaceous, 1—2-celled, 1—2— $\infty$ -seeded, circumsciss. Seeds rotundate-reniform, compressed; embryo annular.

*Species* 10.

*Distribution*:—In warm regions.

Style 1.

Flowers in glomerules . . . . . 1. *T. crystallina*.

Flowers solitary . . . . . 3. *T. monogyna*.

Styles 2 . . . . . 2. *T. pentandra*.

**1. *Trianthema crystallina*** (Forsk.) Vahl Symb. I, 32; DC. Prodr. III, 352; Anders. Journ. Linn. Soc. V, Suppl. p. 20.

*Papularia crystallina* Forsk. Fl. Aeg.-Arab. p. 69.

*Trianthema triquetra* Rottl. (ex Anders.).

*Trianthema sedifolia* Visian. Pl. Aeg. t. 3.

*Description*:—Ascending or diffuse, with spreading or prostrate branches, repeatedly 2—3-chotomous from the base, annual or biennial; branches, at least towards the extremities, and leaves cellular-papillose. Leaves fleshy, oblanceolate-obovate or rotundate, obtuse, much reduced and often roundish and subcordate on profusely flowering branches,  $\frac{1}{4}$ — $\frac{3}{4}$  inch long; petioles sheathing.

Flowers in axillary few- or many-flowered, often dense fascicles. Calyx 5-fid, lobes as long as the tube, ovate or deltoid with a lanceolate or short and obtuse dorsal apiculus. Stamens 5. Ovary truncate, 1-celled, 2-seeded; style 1, as long as the ovary.

Seeds plicate-rugose.

*Flowers*: April 1894 (Lunt).

*Fruits*: June 1872 (Hildebrandt).

*Locality*:—Sandy places of the great valley between Steamer Point and town (Marchesetti); eastern shore of the isthmus between Barrier-Gate and the village of Migrad (Defl.); plain of Maala, nearly sea level (Lunt); common in cemetery (Beevor); without locality (Anders., Birdw., Hildebrandt).

*Distribution*:—Upper Egypt, Nubia, Abyssinia, Kordofan, S. Arabia, Sind, Punjab.

**2. *Trianthema pentandra*** L. Mant. 79; DC. Prodr. III, 352.

*Trianthema obcordata* Wall. Cat. 6837, F.

*Trianthema Govindia* Wall. Cat. 6838.

*Arabic name*:—Rogama (Schweinf.).

*Description* :—Diffuse, much-branched, from a few inches to 2—3 feet high; stems and branches more or less papillose, often nearly smooth and glabrous. Leaves  $\frac{1}{2}$ —2 inches long, elliptic-oblong, sometimes slightly obovate; petioles distinct,  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, dilated at the base.

Flowers in few- or many-flowered sessile or subsessile axillary fascicles; bracteoles thinly membranous. Calyx deeply 5-lobed; lobes ovate-oblong, coloured within, with a short apiculus at the back. Stamens 5. Styles 2.

Capsules  $\frac{1}{8}$  inch long, exserted, the cap with broad deflexed horns, mitriform. Seeds orbicular-reniform, compressed, rugulose, dull-black.

*Flowers* :—August 1898 (Birdw.).

*Locality* :—Aden (Birdw.).

*Distribution* :—Yemen, southern coast of Arabia (common weed in gardens, on sand and water-courses), Tropical Africa, India.

3. *Trianthema monogyna* L. Mant. 69; Schweinf. Bull. Herb. Boiss. (1896) App. II, p. 169.

*Trianthema obcordata* Roxb. Hort. Beng. 24; Wight Ic. t. 228.

*Trianthema pentandra*  $\beta$  *obcordata* DC. Prodr. III, 352.

*Arabic name* :—Riqma (Schweinf.).

*Description* :—A prostrate somewhat succulent herb; stems more or less angular; glabrous or pubescent, much branched. Leaves subfleshy, obliquely opposite, unequal, the upper one of the pair the larger,  $\frac{3}{4}$ — $1\frac{1}{2}$  by  $\frac{3}{4}$ — $1\frac{1}{4}$  inches, the lower  $\frac{3}{8}$ — $\frac{1}{2}$  by  $\frac{1}{4}$ — $\frac{3}{8}$  inch, broadly obovate, rounded and often apiculate at the apex, cuneate at the base, glabrous; petioles  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, much dilated and membranous at the base, especially those of the smaller leaves in which the membranous enlargement forms a triangular pouch.

Flowers solitary, sessile, almost concealed by the pouch of the petiole. Calyx-lobes ovate, acute. Stamens 10—20. Ovary truncate; style 1.

Capsules small, almost concealed in the petiolar pouch, lid truncate, slightly concave, with 2 spreading teeth, carrying away at least one seed, the lower part 3—5-seeded. Seeds reniform, muriculate, dull-black.

*Locality* :—Shaikh O'thman (Schweinf.).

*Distribution* :—Throughout India, Ceylon, and most tropical regions.

## 2. *Orygia* Forsk.

A rigid or somewhat wiry herb. Leaves alternate, rather fleshy, petiolate; no stipules.



Flowers in terminal or leaf-opposed few-flowered cymes. Sepals 5, ovate-cuspidate, with membranous margins. Petals 0. Staminodes many, subhypogynous, narrow, connate at the base. Stamens 12 or more, inserted at the base of the calyx, subhypogynous. Ovary free, globose, 5-sulcate, 5-celled; styles 5, filiform; ovules many, axile.

Capsule subglobose, included in the calyx, 5-celled; loculicidally 5-valved, many-seeded. Seeds reniform, strophiolate.

*Species* 1.

**1. *Orygia decumbens*** Forsk. Fl. Aeg.-Arab. p. 103; DC. Prodr. III, 455; Anders. Journ. Linn. Soc. V. Suppl. p. 20; Boiss. Fl. Or. I, 755; Harv.-Sond. Fl. Cap. I, 136.

*Glinus trianthemoides* Heyne in Roth Nov. Sp. p. 231.

*Portulaca decumbens* Vahl Symb. I, 33.

*Talinum decumbens* Willd. Sp. Pl. II, 864.

*Orygia mucronata* Klotzsch in Peters' Reise nach Mossamb. p. 140, t. 25.

*Axonotichium trianthemoides* Fenzl in Ann. Wien. Mus. I, 354.

*Description* :—Decumbent, diffuse, from a few inches to 1—2 feet high. Leaves  $\frac{1}{2}$ —1 inch by  $\frac{1}{2}$ — $\frac{2}{3}$  inch, alternate, obovate, glabrous, glaucous.

Bracts at the base of the peduncles  $\frac{1}{8}$ — $\frac{1}{6}$  inch long, membranous, pinkish. Flowers light carmine-red. Staminodes about 20, purple-red.

Capsule pale-yellow.

*Flowers* :—April 1844 (Lunt).

*Fruits* :—March 1878 (Perry), Dec. 1847 (Hooker), Dec. 1889 (Defl.).

*Locality* :—From the seashore to a height of 1,000 feet (Edgew., Hooker); Shum Shum Range (Ellenbeck); plain of Maala, valleys near the telegraph office (Defl.); Goldmore Valley, nearly sea level (Lunt); without locality (Perry, Hunter).

*Distribution* :—Africa, Arabia, Baluchistan, Sind, Punjab, Mysore.

### 3. *Mollugo* Linn.

Erect or diffuse glabrous, pubescent or stellately tomentose herbs, often dichotomously branched. Leaves often falsely whorled or alternate, or all radicle, linear, obovate or spathulate; stipules membranous, fugaceous.

Flowers axillary, solitary, fascicled or in diffuse or umbelliform cymes, usually greenish. Sepals 5, subequal, persistent, with membranous margins. Petals 0. Stamens 3—5, subhypogynous, usually alternate

with the sepals, sometimes intermixed with subulate staminodes. Ovary free, 3—5-celled; ovules  $\infty$ , attached to the interior angle of the cells; styles 3—5.

Capsule membranous, included in the calyx, oblong, globose, or subcylindric, 3—5-celled, loculicidally 3—5-valved. Seeds several (rarely 1) in each cell, reniform, appendaged at the hilum or not; embryo more or less curved.

*Species* about 12.

*Distribution*:—Tropical and subtropical regions of both hemispheres.

**1. Mollugo Cerviana** (L.) Seringe MS; DC. Prodr. I, 392; Anders. Journ. Linn. Soc. V, Suppl. p. 7; Boiss. Fl. Or. I, 756; Harv.-Sond. Fl. Cap. I, 138.

Pharnaceum Cerviana L. Sp. Pl. ed. I, p. 388.

*Description*:—An annular erect slender glabrous herb 3—8 inches high. Stems very many, almost filiform; branches umbellate, the nodes thickened. Radical leaves  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, rosulate, spathulate or linear-spathulate. Cauline leaves  $\frac{1}{4}$ — $\frac{3}{4}$  by about  $\frac{1}{30}$  inch, narrow-linear, apiculate, 2—8 in a whorl; petioles obscure.

Flowers numerous, on long filiform stiff pedicels subumbellately arranged, usually in threes on the top of long filiform axillary and terminal peduncles. Sepals  $\frac{1}{10}$  inch long, elliptic-oblong, obtuse, with white membranous margins. Stamens 3—5. Styles 3, very short.

Capsules subglobose, equalling the sepals. Seeds numerous, smooth, without tubercular points, yellowish-brown.

*Flowers*:—March 1878 (Perry).

*Fruits*:—March 1878 (Perry).

*Locality*:—Ravines at the foot of the hill of the telegraph office (Defl.); on sand in the great valley between Steamer Point and town (Marchesetti); under shrubs and in sandy places (Hook., Anders.); without locality (Birdw., Wichura, Perry).

*Distribution*:—Tropical and subtropical countries of the Old World, also in Southern Europe.

#### 4. Limeum L.

Annual or perennial low branched glabrous herbs, sometimes frutescent at the base; branches usually prostrate. Leaves alternate or subopposite, linear-lanceolate, elliptic or obovate, entire or obscurely ciliate; stipules 0.

Flowers small, bracteate, greenish, hermaphrodite or unisexual, in dense terminal and subaxillary cymes. Sepals 5, unequal, ovate, herbaceous or with membranous margins. Petals 3—5, oblong or spathulate, or minute, or 0. Stamens 5—10, sometimes imperfect, hypogynous;

filaments dilated and connate at the base. Ovary free, globose, compressed, 2-celled; ovule solitary in each cell, ascending, with basal funicle; style very short, with 2 branches which are stigmatose within.

Fruit separating into 2 orbicular or hemispheric cocci which at length dehisce ventrally. Seeds vertical; embryo annular; radicle inferior.

*Species* about 10.

*Distribution* :—Tropical and South Africa, Arabia, India.

**1. *Limeum indicum*** Stocks in Herb. Hook.; Anders. Journ. Linn. Soc. V, Suppl. p. 30; Oliv. Fl. Trop. Afr. II, 596.

*Description* :—A prostrate glandular herb; root perennial; stems diffuse, much-branched, glandular-pubescent. Leaves opposite or nearly so,  $\frac{1}{4}$ — $\frac{3}{8}$  by  $\frac{3}{16}$ — $\frac{1}{4}$  inch, broadly elliptic or suborbicular, inequilateral, shortly apiculate, entire, glandular-pubescent; petioles distinct,  $\frac{1}{8}$  inch long, slightly dilated at the base.

Flowers crowded, in axillary subsessile cymes; pedicels short, glandular, bracteate at the base. Sepals  $\frac{1}{10}$  inch long, glandular-pubescent, ovate, acute, with membranous margins. Petals much shorter than the sepals, clawed, truncate and 2-dentate at the apex. Stamens 7 (Stocks), 6—7 (Anderson).

Carpels in fruit as long as the sepals, hemispheric, dehiscent ventrally, the margins of the valves inflexed so as to retain the seed till moistened. Seeds broader than long, about  $\frac{1}{12}$  inch broad, concavo-convex, quite smooth on the back, yellowish-white.

*Flowers* :—January 1863 (Oliver and Cl.), March 1878 (Perry), Dec. 1847 (Hooker).

*Fruits* :—January 1863 (Oliver and Cl.).

*Locality* :—Seashore (Hook.); without locality (Perry, Oliver and Cl.).

*Distribution* :—Nubia, S. Arabia, Sind, Baluchistan, Punjab, Multan.

#### XXIV.—UMBELLIFERÆ.

Usually herbs, rarely shrubs or trees. Leaves usually alternate, simple or compound, usually exstipulate; petiole generally sheathing at the base.

Flowers in simple or compound umbels, rarely in heads or whorls. Calyx-tube adnate to the ovary; teeth 5 or 0. Petals 5, epygynous, distinct, sometimes unequal, usually imbricate in bud. Stamens 5, epygynous. Ovary inferior, 2-celled, crowned by an epygynous, usually 2-lobed disk; ovule solitary in each cell, pendulous; styles 2; stigmas minute, capitate.

Fruit 2-celled, usually separating into 2 indehiscent 1-seeded mericarps which are attached near the apex of their faces to a central axis (carpophore), which usually splits and allows the mericarp to separate from their median plane or commissure, or occasionally remains undivided. Mericarp usually marked by five longitudinal lines (primary ridges), 2 of which are lateral, 1 dorsal at the middle of the back and 2 intermediate, and often with 4 more (secondary ridges) alternating with the primary ones. Seed one in each carpel, pendulous from the point of attachment to the carpophore; testa thin; albumen cartilaginous; embryo minute, straight, near the apex of the seed; radicle superior.

*Genera* 152; *species* about 1,300.

*Distribution*:—Temperate regions, especially of the northern hemisphere, but more or less throughout the world.

### 1. *Ptychotis* Koch.

Annual or biennial herbs. Cauline leaves multifidly capillaceous. Umbels axillary, compound; involucre wanting or few-leaved; involucre of several leaves. Flowers white. Margin of calyx 5-toothed. Petals obovate, bifid, or deeply emarginate, with a long inflexed point proceeding from the sinus. Fruit compressed, ovate or oblong. Mericarps with 5 equal, filiform, primary ridges, the lateral ones marginal. Interstices with single vittæ. Carpophore bi-partite. Seeds terete or gibbously convex, flattish in front.

*Species* 6.

*Distribution*:—Europe, Africa, Arabia.

**1. *Ptychotis arabica*** Anders. Journ. Linn. Soc. V, Suppl. p. 21.

*Arabic name*:—Kelesere.

*Description*:—A small herb, 2—4 inches high, puberulous; stem erect, terete, puberulous with pilose hairs. Leaves herbaceous, sub-tomentose or glabrous, pinnate or bipinnate, slender-petioled; segments ternate, deeply lobate; lobes cuneate, 3—4-fid. Involucrum pentaphyllous; laciniae setaceous, subulate, acute; involucellum 3—5-phyllous. Flowers inconspicuous, white when dry. Petals minute, squamæform, mucronate at the apex; mucro involute. Mericarps 5-costate; ribs glandular-hairy.

*Flowers and fruits*:—February 1851 (Thomson), March 1878 (Perry), April 1861 (Thomson), December 1847 (Hooker).

*Locality*:—Wadi Maala (Schweinf.); top of Shum Shum Range, 1,700 ft. (Hook., Thomson, Deff., Busse; without locality (Birdw., Perry)).

*Distribution*:—Yemen.

## XXV.—RUBIACEÆ.

Trees, shrubs or herbs, prostrate or scandent. Leaves opposite or verticillate, simple, entire ; stipules various, inter- or intra-petiolar, persistent or deciduous, free or connate or adnate to the leaf-base or petiole.

Inflorescence various. Flowers hermaphrodite, rarely unisexual. Calyx-tube adnate to the ovary ; limb various. Corolla inserted on the ovary, various in form and aestivation, tetramerous or pentamerous. Stamens usually isomerous with the corolla-lobes, inserted at the mouth or throat or on the tube of the corolla ; filaments various ; anthers 2-celled. Disk at the top of the ovary, usually annular or cushion-shaped. Ovary inferior, 1—12-celled, usually 2-celled ; ovules 1 or more in each cell ; style simple, bi- or multifid.

Fruit various. Seeds albuminous ; embryo straight or curved.

*Genera* about 350 ; *species* about 4,000.

*Distribution* :—Chiefly tropical and subtropical.

1. *Oldenlandia* L.

Herbs or shrubs with opposite leaves, acuminate or setose stipules adnate to the petiole or leaf-base.

Flowers arranged in terminal or axillary panicles or clusters, small or delicate. Calyx-tube globose obovoid[turbinate or obconic-oblong ; limb regular, deeply 4- or rarely 5-lobed, rarely with alternating teeth. Corolla various in shape, membranous ; tube straight or somewhat curved ; throat glabrous or bearded ; limb 4- or rarely 5-lobed, regular. Stamens 4, rarely 5, inserted in the throat of the corolla ; filaments short. Ovary 2-celled ; ovules numerous ; placentas attached to the septum ; style filiform ; stigmas 2, linear.

Capsule dehiscing longitudinally at or from the apex or dicocious or tardily dehiscent. Seeds angled, globose or ellipsoid ; testa smooth or pitted ; embryo clavate in fleshy albumen.

*Species* about 70.

*Distribution* :—Tropical and subtropical, chiefly Asiatic.

Flowers in corymbose cymes	. . . . .	1. <i>O. Schimperi</i> .
Flowers in racemose cymes	. . . . .	2. <i>O. stricta</i> .

**1. Oldenlandia Schimperi** Anders. Journ. Linn. Soc. V, Suppl. p. 21 ; Boiss. Fl. Or. III, 11 ; Oliv. Fl. trop. Afr. III, 55.

*Kohautia caespitosa* Schnizlein in Flora XXV, Beibl. I, No. 10, p. 145.

*Kohautia Schimperi* Hochst. et Steud in Schimp. Pl. Abyss. no. 879.

*Hedyotis Schimperi* Presl. in Dredge Pl. Cap. exsicc., and Bot. Bem. (1844) p. 85.

*Hedyotis spec. inc.* Edgew. Journ. As. Soc. Beng. XVI, 1216.

*Kohautia arabica* Hochst.

*Oldenlandia retrorsa* Boiss. Fl. Or. III, 12.

*Description* :—An ascendent or decumbent, rigid, glandular-scabrous perennial or annual, 1—3 feet high. Branches virgate, leafy at the base, sparingly so above, terete. Leaves linear, sessile  $\frac{1}{3}$ — $1\frac{1}{2}$  inches long ; stipules 3—1-cuspidate.

Flowers tetramerous,  $\frac{2}{3}$ — $\frac{1}{2}$  inch long, subsessile and pedicellate, in terminal corymbose cymes. Calyx-teeth lanceolate-subulate. Corolla salver-shaped ; tube slender, several times the length of the calyx ; lobes narrowly oval, sub-obtuse,  $\frac{1}{6}$  inch long.

Capsule subglobose, subdidymous, truncate and loculicidally splitting at the apex ; base subturbinate. Seeds angular.

*Flowers* :—March 1878 (Perry), April 1861 (Thomson).

*Fruits* :—February 1851 (Thomson), March 1878 (Perry), April 1861 (Thomson), December 1847 (Hook.).

*Locality* :—Maala (Schweinf.) ; plain of Maala, Goldmore Valley (Defl.) ; Shum Shum Range (Ellenbeck) ; steep gravelly slope at the end of the great valley between Steamer Point and town (Marchesetti) ; in sandy places (Edgew., Madden, Hook., Anders.) ; without locality (Birdw., Perry, Balfour).

*Distribution* :—Nubia, Abyssinia, Kordofan, Kilimandjaro, Sansibar, Socotra, Central and South Arabia, Baluchistan, Sind.

**2. Oldenlandia stricta** Linn. Mant. (1781) 200 ; Hook. Fl. Brit. Ind. III, 68 ; Trim. Fl. Ceyl. II, 316.

*Hedyotis maritima* Wall. Cat. 6192 (partim) ; Moon Cat. 10 ; Thw. Enum. 144.

*Hedyotis graminifolia* Linn. f. Suppl. I, 119.

*Oldenlandia graminifolia* DC. Prodr. IV. 425.

*Description* :—Annual or perennial, with a woody base, and numerous, erect, slender, wiry, sub-quadrangular, glabrous, dichotomously branched stems, often 2 feet high ; leaves 1— $1\frac{1}{2}$  inches, sessile, linear, very acute, glabrous ; stipules adnate to the base of the leaves and with them forming a close sheath round the stem, mouth truncate, ciliate.

Flowers on slender, erect pedicels, few, distant, in slender, erect, elongated, racemose cymes; calyx-segments short, lanceolate, subulate; corolla-lobes oblong, obtuse, longer than the tube.

Capsule  $\frac{1}{8}$  inch long, twice as long as broad, oblong, crowned with the tooth-like calyx-segments, glabrous, top slightly rounded.

*Locality*:—Aden (O. Kuntze Rev. Gen. Pl. I, 292).

*Distribution*:—Ceylon, Southern India, Aden.

## XXVI.—COMPOSITE.

Herbs, shrubs or rarely trees. Leaves alternate or opposite, exstipulate.

Inflorescence a centripetal head of usually many small flowers sessile on the dilated top of the peduncle (receptacle), enclosed in an involucre of whorled bracts. Receptacle sometimes furnished with bracteoles (paleæ, scales), sometimes naked and smooth or with pits. Flowers either all bisexual or some or all 1-sexual. Calyx-tube wholly adherent to the ovary; limb 0 or of scales, bristles or hairs (pappus). Corolla epigynous, gamopetalous, tubular, cylindrical or campanulate, 4—5-dentate with valvate teeth or occasionally very slender with an entire truncate or oblique mouth, or ligulate, the lamina spreading from the centre of the capitulum. Stamens 5 or 4, inserted in the tube of the corolla; filaments free; anthers 2-celled, introrse, cohering into a tube which sheathes the style. Ovary inferior, 1-celled; style filiform, usually bifid; ovule solitary, erect, anatropous.

Fruit an achene, articulated to the common receptacle, generally sessile, naked above or crowned by the persistent sessile or stipitate pappus. Seed erect; testa membranous; no albumen; embryo straight; cotyledons plano-convex; radicle short.

*Genera* about 1,000; *species* about 8,000.

*Distribution*:—Throughout the world.

*Tribe I.*—Vernoniæ: Heads homogamous; flowers all tubular, hermaphrodite. Anther-bases sagittate, rarely subcaudate. Style-arms subulate, hairy. Leaves usually alternate. Corollas never yellow . . . 1. Vernonia.

*Tribe II.*—Inulæ: Heads heterogamous, discoid or rayed; or homogamous, rayless. Anther-bases tailed. Style-arms linear, obtuse, inappendiculate, or the style of the sterile flowers undivided. Leaves usually alternate. Disk- and ray-flowers usually yellow.

*Sub-tribe.*—Plucheinæ: Style-branches of the hermaphrodite florets filiform, not truncate . . . 2. Pluchea.

*Sub-tribe.*—Euinulæ: Style-branches of the hermaphrodite florets wider and rounded at the apex.

Capitula homogamous.

Outer pappus short, not paleaceous . . . 3. Iphiona.

Outer pappus short, paleaceous, lacero-dentate . . . 4. Pegolettia

Capitula heterogamous . . . 5. Pulicaria.

*Tribe III.*—*Mutisieæ*: Heads homogamous; flowers all tubular and hermaphrodite, or the outer bilabiate; or heterogamous, with the ray-flowers female or neuter, sometimes bilabiate. Involucral bracts usually  $\infty$ -seriate, unarmed or spinescent. Receptacle rarely paleaceous. Corollas 2-lipped or with a deeply 5-fid limb. Anthers usually tailed. Style-arms rounded or truncate, inappendiculate. Pappus setose or paleaceous, rarely o. Leaves radical or alternate, rarely opposite. . . . 6. *Dicoma*.

*Tribe IV.*—*Cichorieæ*: Heads homogamous. Corollas all ligulate; ligules truncate, 5-toothed. Anther-bases sagittate, rarely tailed. Style-arms slender. Pappus setose, paleaceous or o. Leaves radicle or alternate, never opposite. Herbs.

Achenes compressed, beaked . . . . 7. *Lactuca*.

Achenes columnar, truncate at both ends . . . . 8. *Launæa*.

### 1. *Vernonia* Schreb.

Herbs, shrubs or trees. Leaves simple, alternate, entire or toothed.

Capitula terminal or axillary, homogamous, cymose or paniced. Involucre ovoid, globose or hemispheric, equalling or shorter than the flowers; bracts in many series, the inner longest. Receptacle naked or pitted, sometimes shortly hairy. Corollas all equal, regular, tubular, slender; lobes 5, narrow. Anther-bases obtuse. Style-arms subulate, hairy. Pappus usually biseriate of many hairs.

Achenes striate, ribbed or angled, rarely terete.

*Species* about 280.

*Distribution*:—Chiefly tropical, mostly in America.

1. *Vernonia atriplicifolia* (Forsk.) Jaub. et Spach. Ill. Pl. Or. IV, 94, tab. 359; Anders, Journ. Linn. Soc. V, Suppl. pp. 21; Boiss. Fl. Or. III, 154; Oliv. Fl. trop. Afr. III, 270.

*Vernonia spathulata* Schultz Bip. ex Aschers. in Schweinf. Beitr. Fl. Aethiop. pp. 162.

*Vernonia arabica* Dene, ex Boiss. Fl. Or. III, 154.

*Chrysocoma spathulata* Forsk. Fl. Aeg.-Arab. pp. 147.

*Description*:—A small shrub, ranging up to 3 feet high, with numerous, dichotomous, spreading branches, covered with close, whitish sericeous, stiff hairs and scattered with sessile glands. Leaves alternate, ovate, varying from oval to rhomboidal, pointed or rounded at the apex, rounded or narrowed at the base, with 1—3 coarse teeth on each side, fleshy, small, subsessile or shortly stalked, ranging up to  $\frac{1}{2}$ —1 inch by  $\frac{1}{4}$ — $\frac{1}{2}$  inch.

Capitula subturbinate, about 12-flowered, in terminal dichotomous or numerous small congested cymes, forming a diffuse leafy panicle.



Scales of the involucre 15—18, pluriseriate, from ovate to oblong-lanceolate, acute. Receptacle naked. Corolla gradually narrowed, glandular. Anther-base acutely produced, apex lanceolate.

Achenes obtusely 5-sided, with short, ascending white setæ between the ridges. Pappus biseriate, outer of short equal, linear, pointed squamæ, inner of white barbellate caducous setæ.

*Locality*:—Plain of Maala, Koosaf Valley (Defl.) ; from the seashore to the top of the Shum Shum Range (Edgew., Hook., Anders.) ; Shum Shum Range (Ellenbeck, Schweinf., Busse) ; without locality (Birdw., Hildebrandt).

*Distribution*:—Yemen, Muscat, Etbai, highlands of Somaliland, Nile-Land.

## 2. *Pluchea* Cass.

Shrubs or herbs, tomentose or glutinose. Leaves alternate, dentate or rarely entire, sometimes pinnatifid.

Heads usually small, in terminal corymbose cymes, or large and subsolitary, heterogamous, disciform, white yellow, or lilac. Outer florets female, in several series, fertile, filiform. Disk-florets hermaphrodite, few, sterile, tubular, 5-fid. Involucre broadly ovoid or campanulate ; its bracts few or in many rows, imbricate, ovate or lanceolate, dry, rigid ; receptacle flat, naked. Corollas of the female flowers filiform, shorter than their own styles, their apices with 3 teeth ; corollas of the hermaphrodite flowers regular, tubular, the limb slightly widened, 5-cleft. Anthers sagittate at the base, their basal auricles tailed. Style-arms of the hermaphrodite flowers filiform, entire or bifid.

Cypselas small, 4- or 5-angled. Hairs of pappus slender, rigid, in a single series, free, or (in the sterile cypselas) connate in groups.

*Species* about 30.

*Distribution*:—Tropical and subtropical.

**1. *Pluchea indica*** Less. in Linnæa (1831), 150 ; DC. Prodr. V, 451 ; Wight Ill. t. 131 ; Clarke Comp. Ind. 93 ; Hook. Fl. Brit. Ind. III, 272 ; Benth. Fl. Austral. III, 527 ; King and Gamble Fl. Malay-Penins. in Journ. Asiatic Soc. Beng. vol. 74, part II, extra N. (1905), 37 ; Prain Beng. Pl. 600.

*Pluchea foliosa* DC. Prodr. V, 451.

*Conyza corymbosa* Roxb. Fl. Ind. III, 426 ; Wall. Cat. 3009.

*Conyza indica* Miq. Fl. Ind. Bat. II, 58.

*Baccharis indica* Linn. Sp. Pl. 1205.

*Description* :—A low shrub, glabrous or nearly so; stems smooth, terete. Leaves membranous, obovate or oblanceolate, the apex obtuse, or acute, acuminate or apiculate, narrowed to the base; edges dentate, serrate or sub-serrate; both surfaces olivaceous-brown when dry; glandular; main-nerves 3—6 pairs, curving upwards; length  $\frac{1}{2}$ — $2\frac{3}{4}$  inches, breadth  $\frac{1}{3}$ — $1\frac{1}{4}$  inches; petioles  $\frac{1}{10}$ — $\frac{2}{5}$  inch long.

Capitula  $\frac{1}{4}$  inch in diameter, in compound puberulous corymbose cymes, much longer than the leaves; involucrel bracts few, rather broad, obtuse. Florets of the disk 3; those of the ray numerous.

Cypselas minute, ribbed, nearly glabrous; pappus scanty, spreading, reddish-white.

*Flowers* :—June 1872 (Hildebrandt).

*Locality* :—On sandy seashore near Shaikh Othman.

*Distribution* :—British India, Malay Archipelago, China, Australia.

*Note* :—Vatke who named Hildebrandt's plant says: "Habitus plantæ summitatibus decerptis paullulum mutatus, sed procul dubio huc refero."—We have not seen the specimen.

### 3. *Iphiona* Cass.

Branching shrubs, more or less glabrous or scabrid, with alternate entire or toothed leaves and yellowish-white capitula, either solitary or cymose.

Capitula homogamous, discoid; florets usually all tubular and hermaphrodite. Involucre campanulate or ovoid, bracts multi-seriate, imbricate, dry, more or less scarious; receptacle narrow, naked. Anther-base sagittate with slender tails.

Achenes subterete or hirsute, 8—10-costate. Pappus 1— $\infty$ -seriate; setæ copious.

*Species* 10.

*Distribution* :—Chiefly Mediterranean and Mascarine.

**1. *Iphiona scabra*** Dene. in Ann. Sc. Nat. ser. II, II, 263; DC. Prodr. VI, 475; Anders. Journ. Linn. Soc. V, Suppl. p. 22; Boiss. Fl. Or. III, 210; Oliv. Fl. trop. Afr. III, 360.

*Description* :—Shrubby, scattered with short, glandular, scabrous pubescence; branches ascending, numerous. Leaves subulate-pungent, sessile,  $\frac{1}{2}$ —1 inch long, with 1—3 spines about  $\frac{1}{3}$  inch long at the base on each side.

Capitula campanulate,  $\frac{1}{2}$  inch long, about 14-flowered, solitary, axillary and terminal, often crowded on pedicels ranging up to 1 inch long. Scales of the involucre 3—4-seriate, puberulous. Receptacle  $\frac{1}{16}$  inch wide, naked.

Achenes oblong,  $\frac{1}{10}$  inch long, sericeous-hirsute, striate. Pappus tawny, multiseriate, unequal, subscabrid.

*Note*:—The leaves vary a good deal. They are usually rigid and spinescent, sometimes herbaceous; the margin is generally entire, but dentate leaves are sometimes to be found.

*Flowers and fruits*:—January 1863 (Oliver and Cl.), February 1851 (Thomson), March 1850 (Madden), March 1878 (Perry), April 1861 (Thomson), April 1844 (Lunt), June 1872 (Hildebr.), November 1888 (Schweinf.), December 1889 (Defl.).

*Locality*:—Near the coal-depôt of the Messag. Marit. (Schweinf.); plain of Maala (Defl.); slope of the Shum Shum Range (Ellenbeck); gravelly slope above Aden at a height of about 500—1,000 feet (Busse); great valley between Steamer Point and town (Marchesetti); very common (Madden, Hook., Thomson, Anders.); Steamer Point,—nearly sea level (Lunt); without locality (Birdw., Hildebrandt, Perry, Oliver and Cl.).

*Distribution*:—Egypt, Nubia, Eritrea, Arabia.

#### 4 *Pegolettia* Cass.

Small, rather rigid half-shrubs or herbs. Leaves alternate, dotted, elliptical or linear.

Capitula terminal solitary or loosely panicle, many-flowered, homogamous, discoid, companulate; florets all tubular fertile. Involucre imbricate in 2—3 rows, shorter than the flowers; scales acute. Receptacle naked, dotted, flat. Corolla tubular, 5-fid, regular (or sub-ringent). Anthers 2-tailed at base. Achenes cylindrical, 10—12-costate, beakless. Pappus in two or three rows, the inner of long, rigid, straight, serrato-ciliate, rarely plumose bristles; the outer much shorter, either of flat, entire or lacerate, unequal scales, or of bristles nearly similar to those of the inner pappus.

*Species* about 10.

*Distribution*:—Tropical and Southern Africa, Arabia.

1. *Pegolettia senegalensis* Cass. Dict. 38, 230; DC. Prodr. V, 481; Jaub. et Spach Illustr. Pl. Orient. IV, 63, t. 341; Oliver Fl. trop. Afr. III, 361.

*Kuhnia arabica* Hochst. et Steud. in Hb. Schimp. Arab. Fel. n. 863; DC. Prodr. VII, 267.

*Description*:—Annual, of loose bushy habit, paniculately branched, scaberulous, with short crisp hispid hairs, subglutinous above,  $\frac{1}{3}$ —2 feet

high ; branches sub-terete, striate. Leaves linear or oblanceolate, deltoid or sub-acute at apex, usually apiculate, gradually narrowed towards the base, sessile, entire or with a few irregular remote teeth above,  $\frac{1}{2}$ — $1\frac{1}{3}$  inches long by  $\frac{1}{16}$ — $\frac{5}{16}$  inch wide ; uppermost smaller, bract-like, subulate.

Capitula campanulate, 18—30-flowered,  $\frac{1}{3}$ — $\frac{1}{2}$  inch long, solitary at the ends of the numerous pedunculiform branches. Scales of the involucre pauciseriate, acute, falling short of the florets ; inner linear-lanceolate, with scarious margins ; outer shorter, linear-subulate, often recurving. Receptacle alveolate ; margins of alveoli toothed. Florets at first yellow, at length purple.

Achenes oblong,  $\frac{1}{8}$  inch long, 10—12-costate, with scattered rather rigid hairs. Pappus biseriate, subfulvous ; inner subplumose ; outer  $\frac{1}{3}$  as long, subpaleaceous, multfid.

*Flowers* :—April 1894 (Lunt).

*Locality* :—Goldmore Valley, 100 feet (Lunt).

*Distribution* :—Senegambia, Kouka, Nubia, ? Abyssinia, Cape Verde Islands, Tropical Arabia.

(Oliver and Hiern in Fl. trop. Afr. mention also Sind, but Cooke has not included this species in his Flora of the Bombay Presidency.)

### 5. *Pulicaria* Gaertn.

Annual or perennial usually woolly or villous herbs. Leaves alternate, sessile, often cordate-amplexicaul.

Heads yellow, solitary, rayed and heterogamous, or disciform and homogamous ; ray-flowers female, 1—2 seriate ; disk-flowers slender, hermaphrodite, fertile. Involucre hemispheric or obconic ; bracts few-seriate, subequal or the outer shorter, linear, acute or subobtus. Receptacle flat or sub-convex, pitted. Corollas of female flowers ligulate or tubular, those of the hermaphrodite flowers regular, tubular, slender, the limb elongate, slightly enlarged, shortly 5-fid. Anther-bases sagittate, with minute auricles ; tails capillary, simple or branched. Style-arms of hermaphrodite flowers linear, obtuse, slightly flattened, a little broader upwards. Pappus double, the outer row of short jagged teeth or a fimbriate cup ; inner of smooth, scabrid or bearded, filiform or flattened hairs, often caducous.

Achenes terete or ribbed.

*Species* about 24.

*Distribution* :—Europe, Africa, Asia, abundant in the Mediterranean region.

Leaves narrow, linear or spatulate-linear, coriaceous	.	.	.	1. <i>P. glutinosa</i> .
Leaves lanceolate, not coriaceous	.	.	.	2. <i>P. adenensis</i> .

**1. *Pulicaria glutinosa*** Jaub. et Spach Ill. Pl. Or. tab. 348.

*Platycheate glutinosa* Boiss. Diag. Pl. Or. ser. I, XI, 5 et Fl. Or. III, 208.

*Description* :—A small shrub, about 1 foot high ; herbaceous parts minutely glandular-puberulous and more or less hirsute with villous, crisp, whitish, more or less elongate, simple, articulate, finally deciduous hairs. Stems woody, terete, erect, irregularly dichotomous. Young branches slender, virgate, terete, striate, erect, leafy. Leaves scattered, coriaceous, thick, concave or subterete-involute, straight or falcate, sessile, exauriculate, narrow, linear or spathulate-linear, entire, callose-mucronate, subdilate at the base ; younger ones glaucescent, older ones green ; the upper leaves smaller than the lower ones and subequal on the same branch.

Peduncles terminal, solitary, 1-headed, ebracteate, erect, terete, short, below the head slightly dilate. Heads campanulate, multi-flowered, homogamous ; involucre campanulate ; bracts 5—6-seriate, densely imbricate. Receptacle glabrous, obsoletely alveolate or areolate. Corolla lutescent, regular, subclavate, 5-nerved, 5-dentate at the apex, subconstricted at the throat, outer side with scattered stipitulate punctiform glands. Stamens inserted a little above the base of the corolla ; filaments capillary, glabrous, almost as long as the anthers ; anthers linear, with short lacerate tails. Ovary columnar, subterete,  $\frac{1}{3}$  of the corolla in length ; unequally 10-costulate, truncate and subcallose at the base ; basilar areola oblique. Pappus whitish, the outer one persistent, very short, coroniform, irregularly crenate-lobulate, the inner one deciduous, of 15—20 setæ, three times the length of the ovary and slightly shorter than the corolla ; setæ spathulate-lanceolate, acute, barbellulate at the apex.

*Locality* :—Aden (Hildebrandt, Ellenbeck). Ex Krause.

*Distribution* :—South Arabia.

**2. *Pulicaria adenensis*** Schweinf. ex O. Kuntze Rev. Gen. Pl. I, 358 et in sched. Herb. Kew.

*Pulicaria iphionoides* O. K. ex O. Kuntze l. c. I, 358.

*Varthemia arabica* T. Anders. Journ. Linn. Soc. V, Suppl. p. 22 (non Boiss.).

*Iphiona arabica* B. Hgp. ex O. Kuntze l. c. I, 358.

*Description* :—A perennial undershrub, 8—12-inches high, leafy, glandular-tomentose ; branches corymbose at the apex. Leaves 1—1 $\frac{1}{2}$  inches long, 1—2 lines broad, lanceolate, attenuate at the base, mucronulate at the apex, entire, puberulous on both sides.

Peduncles terminal, cymose ; scales of involucre lanceolate, acute, adpressed, the outer ones short, subulate. Corolla yellow. Pappus

double ; setæ of outer row very short (three times shorter than the achenes), rigid, of inner row 15-barbate.

Achene  $\frac{1}{2}$  line long, subhirsute.

*Flowers and fruits* :—Jan. 1872 (Thomson), Jan. 1876 (Kuntze), Jan. 1880 (Balf.), March 1878 (Perry), April 1861 (Thomson), November 1888 (Schweinf.), December 1847 (Hook.).

*Locality* :—Near the sea (Hooker) ; Wadi Maala (Schweinf.) ; great valley between Steamer Point and town (Marchesetti) ; without locality (Perry, Balfour, Kuntze, Thomson, Birdw.).

Apparently *endemic* in Aden.

*Note* :—This plant has caused a great deal of confusion. We trust that the following details may help to clear up the doubts existing at present :

J. D. Hooker was the first to collect a specimen at Aden ('near the sea,' Herb. Kew) on the 20th December 1847. When, a few years later, Hooker visited Aden in company with Thomson, they did not gather this plant. Hooker's specimen of 1847 was, therefore, the only material which was at Anderson's disposal when he published his 'Florula' in 1860. The specimen, consisting of a tiny branch with a few flowers, is still preserved at Kew. Anderson called it *Varthemia Arabica* Boiss. Diag. VI, p. 74 (cf. *Florula Adenensis*, p. 22).

Anderson gives this reason for putting the plant under the genus *Varthemia* in spite of its having a double pappus :

"De Candolle describes *Varthemia* as having the pappus uniserial ; in five species that I have examined, in addition to the original species *V. Persica*, the pappus is in two rows, the outer consisting of short rigid setæ." (*Florula* l. c.)

The second specimen was collected by Thomson on the 11th April 1861 and is named *Varthemia arabica* Boiss. in Herb. Kew. A third specimen, gathered by the same botanist in January 1872, shows on its label : *Pulicaria* (*Varthemia arabica* T. Anderson, *non* Boiss.).

On the 9th January 1876, Kuntze made a small collection of Aden plants. Amongst the specimens we find Anderson's *Varthemia arabica* under the new name *Pulicaria iphionoides* O. Kze. to which is added the synonym *Iphiona arabica* B. Hgp. (No. 7648 Herb. Otto Kuntze in Herb. Kew.) No description, however, has ever been published by Kuntze.

Perry's and Balfour's specimens of the years 1878 and 1880 respectively bear the label : *Pulicaria* (*Varthemia arabica* T. Anders.).

Schweinfurth collected the same plant on the 25th November 1888 and named it in his herbarium *Pulicaria adenensis* Schweinf. (= *Varthemia arabica* T. Anders., *non* Boiss.).

This new name was adopted by Kuntze in his *Rev. Gen. Pl. I*, 358, in preference to the one (*Pulicaria iphionoides*) which he himself had chosen at an earlier date. Kuntze retained Schweinfurth's name because Schweinfurth's specimens had been distributed under that name in the meantime. Schweinfurth, however, had given it the specific name '*adenensis*' instead of Anderson's '*arabica*' because there existed already a *Pulicaria arabica* Cass.

Oliver and Hiern, when describing in the *Trans. Linn. Soc. vol. XXIX*, p. 96 (*cf. etiam* Oliver, *Fl. trop. Afr. III*, 365) their new species *Pulicaria Grantii*, added a note saying: "Identified, perhaps incorrectly, with the plant called by Dr. Anderson, in his '*Florula Adenensis*,' p. 22, *Varthemia arabica* (*non* Boiss.) under which name it occurs in App. Speke's *Journ.* 638."—Anderson's plant is not identical with *Pulicaria Grantii*. The latter has much longer and stouter peduncles which become considerably thicker towards the apex, and the capitula are larger.

Krause (*Engl. Bot. Jahrb. XXXV*, Heft 5, p. 56) who has not seen Anderson's plant, considers it to be identical with *Pulicaria glutinosa* Jaub. et Spach. In this I followed him in my '*Flora of Aden*' (*Journ. Bombay Nat. Hist. Soc. vol. XVII*, p. 907, n. 95), but after having examined the type specimens, together with the other specimens at Kew, I came to the conclusion that Anderson's plant is a distinct species.

## 6. *Dicoma* Cass.

Herbs or low shrubs. Leaves alternate.

Heads subsessile on the branches or in the axils of the upper leaves, or leaf-opposed, rarely corymbose, homogamous, discoid, all the flowers hermaphrodite; or heterogamous, the outer flowers being female, all fertile or the innermost sterile. Involucre globose, conic or subcampanulate; bracts  $\infty$ -seriate, imbricate, ovate, lanceolate or linear, acuminate, spinescent or mucronate or with a long apical spine, the outer bracts gradually shorter. Receptacle flat, naked, often pitted. Corollas of hermaphrodite flowers tubular, the limb enlarged, 5-partite, with erect or revolute lobes; corollas of female flowers, if present, slender, subligulate. Anther-bases sagittate; tails long, more or less bearded. Style-arms short, erect, obtuse. Pappus-hairs  $\infty$ -seriate, the inner or all flat, barbellate or feathery, the outer shorter, paleaceous or of slender bristles. Achenes turbinate, densely silky-villous, 5—10-ribbed.

*Species* 13.

*Distribution*:—Tropical and S. Africa, Arabia, India.

1. *Dicoma Schimperii* (DC.) O. Hoffm. in Engl.-Prantl Natürl. Pflanzenfam. IV, 5, 339.

*Hochstetteria Schimperii* DC. Prodr. VII, 287; Anders. Journ. Linn. Soc. V, Suppl. p. 22; Boiss. Fl. Or. III, 219; Hook. Fl. Brit. Ind. III, 988; Oliv. Fl. trop. Afr. III, 444.

*Description* :—An erect rigid, branched, perennial herb, 1—2 feet high; branches slender, erect or ascending, angular, glabrous or pubescent. Leaves alternate,  $\frac{3}{4}$ —2 by  $\frac{1}{4}$ — $\frac{3}{4}$  inch, elliptic-oblong, subobtuse, mucronate, serrulate, araneously pubescent on both sides, attenuated at the base into a short, obscurely winged petiole.

Capitula homogamous, solitary, terminal, discoid,  $\frac{1}{2}$ — $\frac{3}{4}$  inch in diameter. Flowers orange, all hermaphrodite. Involucre hemispheric; bracts  $\infty$ -seriate, narrow, acute, rigid. Corolla regular, tubular, limb 5-partite, lobes more or less revolute. Anther-bases subciliate, the auricles produced into long tails. Style-branches linear, obtuse, flattened. Pappus of 10 stellately spreading paleæ with hyaline margins below the middle, slender and barbellate above, much longer than the achenes.

Achenes turbinate,  $\frac{1}{10}$  inch long, densely villous with long brownish hairs.

*Flowers and fruits* :—Nov. 1889 (Schweinf.), Dec. 1847 (Hook.), Dec. 1889 (Defl.), Feb. 1851 (Thomson).

*Locality* :—Plain of Maala (Defl.); Goldmore Valley (Schweinf.); without locality (Hook., Birdw., Lunt).

*Distribution* :—Nubia, S. Arabia, Sind.

## 7. *Lactuca L.*

Glabrous (rarely hispid) usually milky herbs. Leaves radical and alternate, entire, coarsely toothed or pinnatifid, the margins setoso-ciliate or naked; cauline leaves often amplexicaul and auricled.

Heads variously paniculate, sessile or pedunculate, homogamous; flowers all ligulate, yellow, purple or blue. Involucre cylindric, usually narrow; bracts usually few-seriate, often with scarious margins, the innermost elongate, subequal, the outer often very short. Receptacle flat, naked. Corollas ligulate, truncate and 5-toothed at the apex. Anther-bases sagittate, with acute or shortly setaceo-acuminate auricles (rarely prolonged into lacerate tails). Pappus copious; hairs  $\infty$ -seriate, very slender, simple, persistent or separately deciduous.

Achenes ovoid, oblong or narrow, more or less compressed, sometimes flattened, shortly contracted at the base, abruptly or gradually produced into a beak at the apex; faces 3—5-ribbed, the ribs slender or strong,



smooth or rarely transversely rugose; beak slender or short and cylindric, more or less dilated into an entire or toothed pappiferous disk.

*Species* about 60.

*Distribution* :—Europe, Asia, Africa, and North America.

1. *Lactuca goræensis* (Hochst.) Schultz Bip. in Flora (1842) p. 422; Oliv. Fl. trop. Afr. III, 452.

*Sonchus goræensis* Lam. Enc. Méth. Bot. III, 397.

*Brachyramphus goræensis* DC. Prodr. VII, 177.

*Sonchus ciliatus* Perr. ex DC. Prodr. VII, 177.

*Microrhynchus octophyllus* Hochst. in Herb. Kotsch. Nub. n. 406.

*Lactuca octophylla* Schultz Bip. in Linnæa XV, (1841) 725.

*Lactuca nubica* Schultz Bip. l. c.

*Microrhynchus Hochstetteri* Schultz Bip. ex Hochst. in Herb. Schimp. Abyss. III, n. 1448.

*Lactuca Petitiiana* A. Rich. Fl. Abyss. I, 462.

*Sonchus Hochstetteri* Schultz Bip. in Schweinf. Beitr. Fl. Aethiop. p. 160.

*Description* :—Erect glabrous or subglabrous glaucescent annual or biennial, 1—3 feet high or more, branched at least above. Stem and branches terete. Leaves pinnatifid, often runcinate, mostly acute, ranging up to 8 by 4 inches, sessile, amplexicaul or the lowest ones narrowed into a short winged petiole; lobes variable in breadth and depth, denticulate-ciliate.

Capitula  $\frac{1}{2}$ — $\frac{3}{4}$  inch long, on very short pedicels, in paniced racemose cymes. Inner involucreal bracts 8, linear-lanceolate, scarcely acute or obtuse, with scarious margins; outer bracts ovate-imbricated, much shorter also with scarious margins. Flowers yellow.

Achenes  $\frac{1}{8}$ — $\frac{1}{6}$  inch long, dark, fusiform, tapering to a short pale slender apex, about 10-costate, transversely rugulose. Pappus white,  $\frac{1}{5}$ — $\frac{1}{4}$  inch long.

*Locality* :—Aden (Schweinf.).

*Distribution* :—Yemen, Eritrea, Abyssinia, Kordofan, Upper Guinea, Mozambique.

### 8. *Launæa* Cass.

Perennial or annual glabrous herbs usually with yellow juice. Leaves mostly radical, sinuately lobed or pinnatifid; margins often with cartilaginous or subspinous teeth.

Heads pedunculate or subsessile, solitary, fascicled, racemose or paniculate, homogamous; flowers all ligulate, yellow. Involucre campanulate or cylindric; bracts  $\infty$ -seriate, imbricate, often with scarious

margins; innermost bracts subequal; the outer gradually shorter, the outermost often very short. Receptacle flat, naked. Corollas ligulate, truncate and 5-toothed at the apex. Anther-bases sagittate, with acute or shortly setaceo-acuminate auricles. Style-arms slender. Pappus copious; hairs  $\infty$ -seriate, simple, very slender, white, a few inner sometimes longer and stronger, all connate at the base into a deciduous ring.

Achenes narrow, usually columnar, not contracted at the base or apex, truncate at both ends, sometimes winged, 4—5-ribbed.

*Species* about 20.

*Distribution*:—Mediterranean region of Europe, Canary Islands, Africa, East Indies.

Heads in a lax corymbosely paniculate cyme . . .	1. <i>L. lactucoides</i> .
Heads subracemose along the branches . . .	2. <i>L. nudicaulis</i> .

**1. *Launæa lactucoides*** (Fresen) O. Hoffm. in Engl.-Prantl. Natürl. Pflanzenfam. IV, 5, 370.

*Heterachænia massaviensis* Fresen in Mus. Senckenb. III, 74; Oliv. Fl. trop. Afr. III, 455.

*Brachyramphus lactucoides* Anders. Journ. Linn. Soc. V, Suppl. p. 23.

*Lactuca massaviensis* Schultz-Bip. in Herb. Schimp. Abyss. II, n. 1045, III, n. 1462.

*Sonchus massaviensis* Schultz-Bip. in Schweinf. Beitr. Fl. Aethiop. p. 160.

*Zollikoferia massaviensis* Boiss. Fl. Or. III, 825.

*Description*:—An annual, glabrous, delicately dichotomously branched herb, 1-2 feet high. Branches terete, glaucescent. Leaves alternate; stem-leaves runcinate, more or less deeply pinnatifid or undivided, cordate, auriculate-amplexicaul, sessile, denticulate,  $1\frac{1}{2}$ — $4\frac{1}{2}$  inches long; radical leaves petiolate.

Flowers blue. Capitula homogamous, ligulate, narrowly oblong,  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, 9—10-flowered, on slender pedicels of  $\frac{1}{4}$ —1 inch, in a lax corymbosely paniculate cyme. Involucre cylindrical, at length thickened at the base; inner involucre bracts 5, narrow, lanceolate, obtuse, equal, membranous; the outer ones few, small. Receptacle flat, naked. Ligule truncate, 5-toothed. Anthers sagittate at the base; auricles acute or shortly setaceous-acuminate. Style-arms slender.

Achenes  $\frac{1}{5}$ — $\frac{1}{3}$  inch long; outer ones narrow, dorsally compressed,  $\infty$ -costate, transversely rugulose, attenuate at the base, contracted at the apex into a very short beak; the inner ones narrow, subterete, 4—5-costate, smooth. Pappus copiously setaceous, smooth, persistent or deciduous in one piece.

*Locality*:—Ravine south-west of the Tower of Silence (Defl.); Shum Shum Range at a height of about 1,650 feet (Busse); without locality (Hook., Birdw.).

*Distribution*:—S. Arabia, Socotra, highlands of Somaliland, Abyssinia, Nubia.

**2. *Launæa nudicaulis*** Less. Synops. p. 139; Hook. Fl. Brit. Ind. III, 416.

*Zollikoferia nudicaulis* Boiss. Fl. Or. III, 824; Batt. et Trab. Fl. d'Alg., p. 558.

*Brachyramphus obtusus* DC. Prodr. VII, 177.

*Lactuca obtusa* C. B. Clarke Comp. Ind. p. 261, (not of Benth.!).

*Microrrhynchus nudicaulis* DC. Prodr. VII, 186.

*Microrrhynchus patens* DC. l. c. p. 181.

*Microrrhynchus fallax* Jaub. et Spach in Walp. Ann. II, 976.

*Prenanthes patens* Wall. Cat. n. 3258.

*Prenanthes procumbens* Roxb. Fl. Ind. III, 405.

*Arabic name*:—Hendibe (Schweinf.).

*Description*:—Glabrous, 6—24 inches high, branched. Leaves 2—10 by 1—3 inches, mostly radical; lower leaves obovate-oblong, pinnatifid, with rounded or very obtuse segments, spinulose on the margins with white cartilaginous teeth; cauline leaves distant, few, sessile, narrowly oblong, pinnatifid. Flowering stems decumbent or spreading, irregularly branched.

Heads  $\frac{1}{2}$ — $\frac{3}{4}$  inch long, cylindric, remotely subracemose along the branches, shortly pedicelled, subsolitary or fascicled (sometimes 6—10 in a cluster), supported by leaves or naked. Involucral bracts all with broad white membranous margins; the outer very short, ovate, acute, with a strong midrib, subcordate; the innermost thrice as long as the outer, reaching  $\frac{1}{2}$  inch long, linear, subacute, longer than the pappus, the midrib thickened in front. Pappus-hairs subequal, soft, white, copious.

Achenes  $\frac{1}{10}$ — $\frac{1}{8}$  inch long, polymorphous; inner sometimes as if composed of 4 thick ribs; outer slightly curved and flattened, with a thick ventral and several thick dorsal ribs, all smooth or obscurely uneven.

*Locality*:—Gravelly slopes of the Shum Shum Range (Hildebrandt, Ellenbeck); without locality (Birdw.).

*Distribution*:—S. Spain, Canaries, N. Africa, Arabia, Sind, Punjab, Afghanistan.

## XXVII.—PLUMBAGINACEÆ.

Herbs or shrubs, often maritime. Radical leaves rosulate, cauline leaves alternate.

Flowers capitate or spicate; spikes solitary or paniced. Calyx inferior, gamosepalous, tubular or infundibuliform, more or less distinctly 5-lobed. Corolla hypogynous, gamopetalous, hypocateriform, or petals nearly or wholly free, oblanceolate or obovate, imbricate. Stamens as many as and opposite to corolla-lobes or petals, adnate to the base of the tube or claw, or inserted with the petals on a narrow hypogynous ring. Ovary free, 1-celled, often 5-sulcate; styles 5, free from the base or more or less connate; ovule solitary, anatropous, suspended from a long basal funicle.

Fruit dry, dehiscent or indehiscent; seeds with or without albumen; embryo straight.

*Genera* 8; *species* about 200.

*Distribution*:—More or less throughout the world, chiefly maritime or in saline or rocky deserts.

### 1. *Statice* L.

Usually perennial herbs from a woody or wiry stock, or more or less shrubby and diffusely branched. Leaves alternate, often rosulate or fascicled, linear-spathulate to obovate.

Flowers in unilateral, bracteate, paniced spikes. Calyx funnel-shaped or tubular; limb plicate, hyaline or scarious, 5-toothed or lobed. Petals 5, either free from the base, or the base of the claws connate in a ring, oblanceolate or obcaudate. Stamens adnate to the base of the petals. Styles free from the base or nearly so.

Utricle indehiscent, or circumsciss or variously fissured. Seed filling the cell, more or less albuminous.

*Species* about 100.

*Distribution*:—Cosmopolitan on sea-shores and in salt-marches.

Leaves not cylindrical . . . . .	1. <i>S. axillaris</i> .
Leaves cylindrical . . . . .	2. <i>S. cylindrifolia</i> .

1. *Statice axillaris* Forsk. Fl. Aeg.-Arab. p. 58; DC. Prodr. XII, 663; Boiss. Fl. Or. IV, 868; Anders. Journ. Linn. Soc. V, Suppl. p. 29; Oliv. Fl. trop. Afr. III, 486.

*Statice Bovei* Jaub. et Spach. Ill. Pl. Or. I, 157, tab. 86.

*Statice lanceolata* Edgew. Journ. As. Soc. Beng. XVI, 1218.

*Description*:—A low, glabrous shrub with decumbent or ascending leafy branches or scapes erect from a woody stock. Leaves oblanceolate or oblanceolate-spathulate, entire or retuse, glabrous, fleshy,

glaucous, attenuate into the petiole; petiole fuscous at the base, sheathing the stem; scape axillary or subterminal, paniculate, subterete, smooth, glabrous,  $\frac{1}{2}$ —1 foot high.

Flowers in compound spikes; spikelets 2—3-flowered. Bracts persistent, coriaceous, fuscous; inner bracts glabrous or nearly so, smooth, with scarious margin, about 3 times longer than the outer. Calyx infundibuliform, more or less pilose below, persistent, 5-costate; margin with shallow rotundate-deltoid lobes.

*Flowers*:—Nov. 1888 (Schweinf.), Dec. 1847 (Hook.), Dec. 1889 (Defl.), February 1851 (Thomson), April 1861 (Thomson).

*Locality*:—On the sea-shore, top of Shum Shum Range (Edgew., Hook., Thomson, Madden, Anders.); Wadi Maala, near the coal-dépôt of the Messag. Marit. (Schweinf.); plain of Maala (Defl.); upper end of great valley between Steamer Point and town (Marchesetti); slope of Shum Shum Range (Ellenbeck, Busse); without locality (Birdw., Wichura, Hildebrandt).

*Distribution*:—Yemen, Socotra, highlands of Somaliland, Eritrea, Nubia.

**2. *Statice cylindrifolia* Forsk. Fl. Aeg.-Arab. p. 59; DC. Prodr. XII, 664; Vahl Symb. I, 26 tab. 10.**

*Arabic name*:—Tissumm (in S. Arabia).

*Description*:—Branches shrubby, leafless at the base, leafy in the upper part. Leaves fleshy, terete, linear-cylindric, obtuse, mucronulate, pruinose, straight or incurved, slightly thicker in the upper part, dilate at the base into a short amplexicaul fuscous sheath; axillary branches short flexuose.

The 2-flowered spikelets distichously arranged forming short secondary spikes; bracts obtuse, membranous, outer one rounded, upper one oblong, with the margins involute, including the flowers. Calyx-tube glabrous, fuscous; limb whitish, 5-lobed, with 5 fuscous nerves.

*Locality*:—Eastern shore of the isthmus between Barrier-Gate and the village of Migrad (Hildebrandt, Schweinf., Defl.).

*Distribution*:—Yemen, Socotra, Eritrea.

*Note*:—In Kew Herbarium there is under the name of *Statice axillaris*, a coloured sketch by Colonel Playfair of an Aden plant which shows greater resemblance with *Statice cylindrifolia* than with *S. axillaris*. Balfour, however (in 'Botany of Socotra,' p. 149), did not like to call it *S. cylindrifolia*, because he had not seen specimens of such a

plant from Aden. Besides, Anderson does not notice it and there was no record of its occurrence at Aden available at the time of Balfour's publication. Since then, however, the plant has been observed by Schweinfurth and Defflers and even before that, in 1872, by Hildebrandt. It is, therefore, quite possible that Playfair's sketch represents the true *S. cylindrifolia*.

Graham in the 'Addenda' to his 'Catalogue of the plants growing in Bombay and its vicinity' (1839) describes *Eurychiton Adensis*, N. as an Aden plant, and gives the following diagnosis:

"Calyx gamosepalous, infundibuliform, subscarious, with a slightly 5-lobed plaited limb; and subtended by scarious bractææ. Corolla gamopetalous, funnel-formed, smaller than the calyx and purple coloured. Stamens 5 hypogynous. Styles 5, seed vessel not seen.

"Stem short and branching, leaves obovate oblong, flat, pubescent glaucous-mucronate, attenuated into long petiole which is sheathing at the base. Peduncle erect, panicle circinate, flowers one-ranked."

This plant was referred by Bentham and Hooker (Gen. Pl. II, 626) to *Statice*, and they remark: "Si corolla recte gamopetala descripta ad sectionem Siphonantham pertinet. Collectores recentiores in viciniis Aden *S. axillarem*, Forsk. solam invenerunt quæ ad Limonii species suffruticosas habitu Armeriastro accedentes pertinet."

As a matter of fact, Graham's plant seems to be neither the one nor the other of the species here described. His description of the flower suits *S. cylindrifolia* and that of the foliage *S. axillaris*.

## XXVIII.—SALVADORACEÆ.

Shrubs or trees, usually glabrous. Leaves opposite, entire; stipules minute.

Flowers small, hermaphrodite or diœcious, in paniced spikes or racemes. Calyx free, 3-4-toothed or 4-fid. Corolla 4-merous, shortly campanulate, imbricate in bud. Stamens 4, inserted on the corollatube or near the base of the petals, alternate with the lobes or petals; filaments free or connate at the base; anthers ovate. Ovary superior, 1—2-celled; ovules 1—2 in each cell, erect from its base, anatropous; style short; stigma bifid or subentire.

Berry or drupe usually 1-seeded. Seed globose or compressed; albumen 0; cotyledons fleshy, plano-convex.

Genera 3; species about 9.

*Distribution*:—Tropical and subtropical Asia, Africa, Madagascar, Malaya.

Corolla gamopetalous . . . . .	1. <i>Salvadora</i> .
Petals free . . . . .	2. <i>Dobera</i> .

# 1. *Salvadora* Linn.

Shrubs or trees with opposite, entire leaves.

Flowers along the branches of axillary or terminal panicles. Calyx campanulate, 4-fid. Corolla campanulate; tube short; lobes 4, obtuse, imbricate in bud. Stamens 4, epipetalous; filaments slightly flattened. Ovary 1-celled; ovule solitary; style very short or almost 0; stigma broad, truncate or subpeltate.

Drupe globose, supported by the persistent calyx and corolla; endocarp crustaceous. Seed erect, globose.

*Species 2.*

*Distribution* :—East Africa, Arabia, India.

Inflorescence 2—5 inches long; fruit red when ripe . 1. *S. persica*.

Inflorescence 1—1½ inches long; fruit yellow when ripe . 2. *S. oleoides*.

**1. *Salvadora persica* L.** Sp. Pl. ed. I, p. 122; Vahl. Symb. I, 12, tab. IV; DC. Prodr. XVII, 28; Roxb. Cor. Pl. t. 26; Wight Ic. t. 1621; Boiss. Fl. Or. IV, 43; Hook. Fl. Brit. Ind. III, 619.

*Salvadora Wightiana* Planch. in Thw. Enum. 190; Bedd. Fl. Sylv. t. 247.

*Salvadora indica* Wight Ill. II, 229, t. 181.

*Salvadora crassinervia* Hochst. in Schimp. Pl. Abyss. n. 2218.

*Cissus arborea* Forsk. Fl. Aeg.-Arab. p. 32.

*Embelia grossularia* Retz Obs. IV, 24.

*Salvadora paniculata* Zuccar. (ex Anderson).

*Arabic name* :—Râk, Rhag; name of the fruit 'Kabath' (Forskahl).

*Description* :—A large, much-branched, evergreen shrub or small tree with soft whitish-yellow wood; bark of old stems rugose; branches drooping, glabrous, terete, striate, shining, almost white. Leaves somewhat fleshy, glaucous, 1½—2½ by ¾—1½ inches, elliptic-lanceolate or ovate, obtuse and often mucronate at the apex; base usually acute, less commonly rounded; main nerves 5—6 pairs; petioles ½—¾ inch long, glabrous.

Flowers greenish-yellow, in axillary and terminal compound lax panicles 2—5 inches long; pedicels  $\frac{1}{16}$ — $\frac{1}{8}$  inch long; bracts beneath the pedicels ovate, very caducous. Calyx  $\frac{1}{10}$  inch long, cleft half-way down; lobes rounded. Corolla  $\frac{1}{8}$  inch long, deeply cleft, persistent; lobes oblong, obtuse, reflexed. Stamens exerted.

Berries  $\frac{1}{8}$  inch in diameter, globose, smooth, red when ripe.

*Flowers* : March 1878 (Perry).

*Fruits* : November 1888 (Schweinf.).

*Locality* :—Plain of Maala (Schweinf., Defl.); northern side of Shum Shum Range (Defl.); without locality (Perry).

*Distribution* :—Tropical Africa, Syria, Arabia, S. Persia, drier parts of India, Ceylon.

*Uses* :—The natives of Aden eat the berries and use the woody branches for cleaning the teeth. In Yemen the plant is used for other purposes. Forskahl writes: "In magno est pretio. Fructus maturus edulis. Folia contusa imponuntur tumoribus Uarm dictis et bubonibus Riahl. Sed vis antitoxica adeo famosa, ut carmine quoque celebretur." (Flora Aeg. Arab. p. 32.)

**2. *Salvadora oleoides* Dene.** in Jacquem. Voy. Bot. (1844) 140, t. 144; A. DC. Prodr. XVII, 28; Brandis For. Fl. 316, t. 39; Hooker Fl. Brit. Ind. III, 620; Aitchis. Pb. and Sind Plants 91; Talb. Trees Bomb. ed. 2, 220; Watt. Dict. Econ. Prod. VI, part II, 447; Cooke Fl. Bomb. Pres. II, 121.

*Salvadora Stocksii* Wight. Ill. II, 229, et Ic. t. 1621.

*Salvadora indica* Royle Ill. 319.

*Salvadora persica* T. Anders. in Journ. Linn. Soc. V, Suppl. p. 29.

*Description* :—A shrub or occasionally a small tree with a short twisted or bent trunk; branches numerous, stiff, divergent, whitish. Leaves  $1\frac{1}{2}$ —3 by  $\frac{1}{8}$ — $\frac{1}{2}$  inch, whitish-green, coriaceous and somewhat fleshy when mature, linear-lanceolate or elliptic-lanceolate, acute or subobtusate, often mucronate, glabrous; main nerves indistinct; petioles  $\frac{1}{8}$ — $\frac{1}{4}$  inch long.

Flowers greenish-white, sessile, in erect axillary paniced spikes 1— $1\frac{1}{2}$  inches long, often clustered. Calyx  $\frac{1}{16}$ — $\frac{1}{12}$  inch long, cleft about half-way down; lobes 4, rounded, obtuse. Corolla a little longer than the calyx, deeply cleft; lobes obovate-oblong, obtuse.

Drupe  $\frac{1}{8}$ — $\frac{1}{5}$  inch in diameter, subsessile, globose, yellow when ripe.

*Locality* :—Aden (Hooker, Thomson, Balfour).

*Distribution* :—Gujarat, Sind, Rajputana, Punjab, Aden.

## 2. *Dobera* Juss.

A glabrous tree. Leaves opposite, entire.

Flowers small, polygamo-dioecious, clustered on the branches of an axillary inflorescence, trichotomous in the males, subsimple in the females. Calyx ovoid, irregularly valvate, 2—4-toothed. Petals 4 (or 5), narrowly oblong, free, imbricate. Stamens 4 (or 5), filaments connate into a tube; anthers lanceolate, dehiscing laterally or subextrorsely. Scales 4—5 outside the staminal tube, alternate with the stamens. Ovary probably 2-celled with one erect ovule in each cell.



Fruit a subglobose berry ; seed solitary, globose, exalbuminous.

*Species* 1.

*Distribution* :—Yemen, Abyssinia, Kordofan (probably not in India).

**1. *Dobera glabra* (Forsk.) DC. Prodr. XVII, 31.**

*Tomex glabra* Forsk. Fl. Aeg.-Arab. p. 32.

*Dobera Roxburghii* Planch. in Ann. Sc. Nat. 3, X, 191 ; Hook. Fl. Brit. Ind. III, 619.

*Schizocalyx coriaceus* Hochst. in Flora (1844) Beil. 2.

*Blackburnia oppositifolia* (*error pro B. monadelpha*) Roxb. Fl. Ind. ed. C. and W. I, 435, fide Planch. l. c.

*Arabic name* :—Dobra.

*Description*.—A fine tree. Leaves  $3\frac{1}{2}$ — $1\frac{1}{2}$  inches, elliptic, acute, mucronate or obovate-obtuse, coriaceous ; petiole  $\frac{1}{8}$ — $\frac{1}{6}$  inch.

Panicles  $1\frac{1}{2}$ —3 inches ; bracts 0 ; bracteoles  $\frac{3}{8}$  inch, ovate, close to the calyx. Calyx  $\frac{1}{10}$  inch, ovate-cylindric, subspathaceous. Petals  $\frac{1}{2}$  inch, white, free. Filaments united for two-thirds their length into a sub-quadrangular tube.

Berry  $\frac{3}{4}$  inch in diameter ; endocarp crustaceous.

The structure of the ovary needs further examination. Bentham and Hooker call it 1-celled, Hochstetter 4—5-celled, Forskal 2-celled and Knoblauch 'probably 2-celled.'

*Locality* :—Little Aden : dunes at the entrance of ravines on the southern side of the Jebel Ihsan (Defl.).

*Distribution* :—Yemen, Abyssinia, Kordofan.

## XXIX.—APOCYNACEÆ.

Trees, shrubs or herbs with simple entire leaves ; juice frequently milky ; stipules 0 or small gland-like, intra- or inter-petiolar.

Flowers regular, in terminal or axillary cymes. Calyx inferior, often glandular ; lobes 5—4, imbricate. Corolla gamopetalous, usually rotate or hypocrateriform ; lobes 5—4, spreading, contorted, and often twisted in bud. Stamens 5—4, epipetalous ; filaments usually short ; anthers linear-oblong or sagittate, cells 2, dehiscing longitudinally ; pollen granular. Disk various. Ovary 1-celled with 2 parietal placentas, or 2-celled with axile placentas, or of 2 distinct or partially connate carpels ; style one, simple or divided at the base ; stigma various.

Fruit a dry or fleshy drupe, berry or samara, or of 2 drupes, berries or follicles. Seeds various, sometimes winged, sometimes with a pencil

of hairs (coma) ; embryo straight ; cotyledons flat, concave, convoluted or contorted.

*Genera* about 110 ; *species* about 900.

*Distribution* :—Chiefly tropical.

### 1. *Adenium* Roem. et Sch.

Shrubs with fleshy, globose stems and entire leaves.

Flowers near the end of the branches, shortly pedicelled, purple. Calyx 5-partite ; lobes lanceolate, glandular. Corolla-tube cylindric below, pubescent on the outside, subpubescent on the inner side ; lobes convolute in æstivation, shorter than the tube. Filaments 5, very short ; anthers linear-sagittate, coherent with the stigma. Ovaries 2, globose or elliptic, glabrous. Style 1 ; stigma capitate, apex bidentate, margin 5-dentate, base surrounded by a reflexed cupuliform membrane. Ovules  $\infty$  pendulous, imbricate.

Fruit 2 follicles. Seeds cylindric-prismatic, comose at both extremities ; testa striate ; albumen scanty ; embryo straight ; radicle superior, ovoid-oblong, apex conical ; cotyledons much shorter than the radicle, ovate, foliaceous.

*Species* 5.

*Distribution* :—Arabia, Africa.

**1. *Adenium arabicum*** Balf. f. Trans. Roy. Soc. Edinb. XXX, 162.

*Adenium* Honghel Bot. Reg. XXXII, t. 54 (*Ic. tantum, non descript.*) non DC. Prodr. VIII, 412.

*Adenium obesum* Anders. Journ. Linn. Soc. V, Suppl. p. 23 (*syn. partim excl.*) non Roem. et Schult.

*Adenium obesum* Hook. Bot. Mag. t. 5918 (*Ic. tantum, non descript.*).

*Arabic name* :—Aden, Aobbiana.

*Description* :—A shrub, 1—3 feet high, with milky juice. Stem thick, globular-gouty, 1—2 feet in circumference, fleshy, rapidly diminishing to short stout branches. Branches terete, aphyllous, dichotomous. Leaves crowded near the apex of the branches, elliptic, ovate or spatulate, subpetiolate, obscurely mucronate, entire, veinless, glabrous, glaucous on the lower surface.

Pedicels solitary or geminate, subaxillary or terminal, villous. Flowers bright rosy, longer than the leaves ( $1\frac{1}{2}$ —2 inches). Calyx-segments lanceolate, pubescent. Corolla puberulous on the outside ; lobes rotundate, obtuse, with 5 villous lines interiorly ; limb 1 inch broad. Ovaries globose.

*Flowers* :—March 1862 (Playfair), May 1859 (Anders.), Dec. (Schweinf.).

*Fruits* : March 1862 (Playfair).

*Locality* :—Shum Shum Range (Schweinf., Marchesetti); rock near the flag-staff, hill between Maala and the Goldmore Valley, ravine on the northern side of the Shum Shum Range above Maala, south-eastern corner of the crater (Defl.); on rocks (Hook., Anders.); abundant on the hill crags, but now difficult to obtain (Balfour); without locality (Beevor; Birdw., Playfair).

This plant is a great favourite in the little gardens of Steamer Point on account of its bizarre shape and beautiful rosy flowers.

*Distribution* :—Yemen.

*Note* :—According to Schumann (Symb. Phys. Pars bot. 1900, p. 5) another species of *Adenium* would occur at Aden, viz. :—

*Adenium obesum* (Forsk.) Roem. et Schult. Syst. Veg. IV., 411, of which he gives the following synonyms :

*Adenium Honghel* A. DC. C. in Prodr. VIII, 412.

*Nerium obesum* Forsk. Fl. Aeg.-Arab. 205.

*Cameraria obesa* Sprengel Syst. I, 641.

*Pachypodium obesum* G. Don. Gen. Syst. IV, 80.

*Adenium arborescens* Ehrenberg.

In addition he wishes to be included :

*Adenium multiflorum* Kl. and A. *Boehmianum* Schinz.

I doubt whether there are two species of *Adenium* at Aden. The specimens I have been able to examine do certainly not belong to *Adenium obesum* Roem. et Schult., but to *A. arabicum* Balf. The genus requires careful revision, and as its representatives are very variable, there is no hope of deciding the numerous doubtful points without detailed observations *in loco*.

*Cf. etiam* Balfour in his Botany of Socotra and Stapf's diagnoses.

### XXX.—ASCLEPIADACEÆ.

Herbs or shrubs, often with milky juice. Leaves opposite or whorled, rarely alternate, entire, exstipulate.

Flowers regular, solitary or few or many together in umbels, umbellate cymes, fascicles or racemes. Calyx inferior, usually divided to the base or nearly so; segments imbricate. Corolla various, gamopetalous, 5-lobed; tube usually short, often furnished with a ring of scales or processes (corolline corona); lobes imbricate, contorted or valvate in æstivation. Stamens 5, alternating with the corolla-lobes; filaments usually connate into a fleshy tube (staminal column), with its apex often united to the dilated part of the style, usually with fleshy scales or processes on the back (staminal corona); anthers free or united to the dilated

part of the style, 2-celled, the margins of the anthers or their basal prolongations below the cells more or less horny and wing-like (anther-wings), the adjacent wings of each pair of anthers nearly meeting and forming narrow fissures leading to the stigmatic cavities; pollen forming 1 or 2 granular or waxy masses (pollinia) in each cell, the pollinia of the adjoining cells of two contiguous anthers united in pairs or fours either directly or by appendages (caudicles) to each of the 5 minute turgid or 2-fid bodies (pollen-carriers or corpuscles) which lie on the dilated part of the style. Ovary superior, of 2 one-celled distinct carpels enclosed within the staminal column, with their styles united above into a disk which is 5-angled, or produced beyond the anthers into a long or short simple or bifid column; ovules usually numerous, anatropous, pendulous, imbricate in several series on the projecting placenta.

Fruit a pair of follicles; the seeds usually crowned by a tuft of hairs. Endosperm slight, cartilaginous; radicle superior; cotyledons flat.

*Genera* about 220; *species* about 1,800.

*Distribution*:—Mostly confined to the tropics, but a few in temperate regions.

#### Corona corolline

- |  |                  |
|--|------------------|
| Gynostegium sessile or short-stipitate . . . | 1. Glossonema.   |
| Gynostegium distinctly stipitate . . .       | 4. Steinheilina. |

#### Corona staminal

##### Stem erect

##### Shrubs or trees, with many leaves

- |  |                |
|--|----------------|
| Leaves linear-lanceolate or linear . . . | 7. Kanahia.    |
| Leaves broad . . .                       | 2. Calotropis. |

- |                                    |               |
|------------------------------------|---------------|
| Herbs, leafless or almost so . . . | 6. Caralluma. |
|------------------------------------|---------------|

##### Stem twining

- |                          |                 |
|--------------------------|-----------------|
| Leaves not cordate . . . | 3. Pentatropis. |
| Leaves cordate . . .     | 5. Dæmia.       |

### 1. Glossonema Dene.

Dwarf perennial, rarely annual herbs, often hoary, branched from the base. Leaves opposite.

Flowers in few-flowered lateral or sublateral cymes arising from between the base of the petioles, rarely solitary. Calyx 5-partite. Corolla subcampanulate; lobes 5, overlapping to the right; corona arising from the corolla-tube, of 5 broad hyaline lobes alternating with the corolla-lobes. Staminal column short; anthers terminated by an inflexed membrane; pollen-masses pendulous, solitary in each anther-cell, attached in pairs to the pollen-carriers by very short caudicles. Style-apex usually exerted beyond the anther, fleshy conical, clavate or peltate

Follicles thick, acuminate, usually echinate. Seeds comose.

*Species 7.*

*Distribution* :—Tropical Africa, Arabia, Persia, Baluchistan, Sind.

**1. *Glossonema Boveanum*** Dene. in Ann. Sc. Nat. ser. II, IX, 335 ; Anders. Journ. Linn. Soc. V, Suppl. p. 24 ; Boiss. Fl. Or. IV, 61 ; This.-Dyer Fl. trop. Afr. IV, 292.

*Gomphocarpus pauciflorus* Hochst. et Steud. in Schimp. Pl. Abyss. n. 920.

*Petalostemma chenopodii* R. Br. in Salt Voy. Abyss. App. p. 64.

*Glossonema affine* N. E. Br. in Kew Bull. (1895) p. 249.

*Description* :—A dwarf herb, 3—10 inches high, branching from the base. Stems ascending, more or less pubescent with white hairs. Leaves spreading ; petiole 1—6 lines long ; blade  $\frac{1}{3}$ — $1\frac{1}{2}$  inches long,  $1\frac{1}{2}$ —7 lines broad, ovate, or ovate-lanceolate, acute or obtuse, cuneately narrowed or broadly rounded into the petiole at the base, more or less undulate or crisped on the margins, thinly or densely white-pubescent on both sides or glabrous above.

Flowers 1—3 together, sublateral ; pedicels 1— $1\frac{1}{2}$  lines long, white-pubescent. Sepals  $1\frac{1}{4}$ — $1\frac{1}{2}$  lines long, lanceolate, acute, pubescent. Corolla-tube 1 line long, campanulate ; lobes spreading,  $1\frac{1}{2}$ —2 lines long,  $\frac{3}{4}$ —1 line broad, oblong or oblong-ovate, obtuse or subacute, slightly thickened above or subtuberculate near the apex, with the margins recurved, glabrous or with a few hairs on the back. Coronal-lobes arising a short distance below the sinuses of the corolla,  $1\frac{3}{4}$ —2 lines long,  $\frac{3}{4}$  line broad in the broadly oblong basal half, 3-lobed, with the middle lobe long and filiform, or subtruncately or somewhat abruptly contracted into a filiform or subulate point, or occasionally filiform-acuminate. Staminal-column 1 line long ; anther-appendages reniform, very obtuse. Style protruded for about  $\frac{1}{4}$  line beyond the anther-appendages ; apical part stout, conical, obtuse or shortly bifid.

Follicles  $1\frac{1}{2}$ —2 inches long, 7—11 lines thick, ovoid, acute, strongly echinate, minutely pubescent or nearly glabrous. Seeds about 2 lines long,  $1\frac{1}{2}$  lines broad, ovate, flattened, very minutely scaberulous, dark brown.

*Flowers* :—April 1894 (Lunt).

*Fruits* :—January 1872 (Thomson), April 1894 (Lunt).

*Locality* :—Goldmore Valley, hill near Steamer Point, above Maala (Schweinf.) ; ravine on the northern side of the Shum Shum Range, Koosaf Valley, ravine south-west of the Tower of Silence (Defl.) ; top of Shum Shum Range above 1,400 feet (Busse) ; Aden port, nearly sea-level

(Lunt) ; without locality (Edgew., Boycott, Thomson, Birdw.). Little Aden (Defl.).

*Distribution* :—Yemen, Abyssinia, Eritrea, Nubia, Upper Egypt.

## 2. *Calotropis* R. Br.

Erect shrubs or small trees with opposite, broad, subsessile leaves.

Flowers in umbellate or subracemose lateral pedunculate cymes. Calyx of 5 distinct sepals, glandular inside, broadly ovate ; corolla campanulate or subrotate, divided more than half-way down ; lobes broad, valvate ; corona of 5 fleshy, laterally compressed lobes, adnate to and standing out as wide buttresses from the staminal column with an upcurved and involute spur at the base and bifid at, or with 2 auricles a little below, the apex. Anthers short and broad, with membranous appendages inflexed over the depressed pentagonal summit of the style-apex ; pollen-masses solitary in each anther-cell, pendulous, attached to the pollen-carriers by short caudicles.

Follicles short, thick, not echinate. Seeds comose, flat, ovate.

*Species* 4.

*Distribution* :—Africa, India, S. China, Malay Archipelago.

**1. *Calotropis procera*** (Forsk.) R. Br. in Herb. Kew. ed. 2, p. 78 ; Dene. in DC. Prodr. VIII, 585 ; A. Rich. Tent. Fl. Abyss. II, 33 ; Vatke in Linnæa XV, 213 ; Ham. in Trans. Linn. Soc. XIV, 246 ; Boiss. Fl. Or. IV, 57 ; Hook. Fl. Brit. Ind. IV, 18 ; Batt. et Trab. Fl. d'Alg. p. 585.

*Calotropis Wallichii* Wight. Contr. p. 54.

*Calotropis Hamiltonii* Wight. Contr. p. 53.

*Calotropis heterophylla* Wall. Wight Contr. p. 54.

*Calotropis procera* Willd. Sp. Pl. I, 1263 ; Del. Frag. Fl. Arab. Petr. p. 13.

*Asclepias gigantea* L. ex synonym. Prosp. Alpini.

*Apocynum syriacum* Clus. Hist. 2, p. 87.

*Apocynum patula* Auch. exsicc. n. 1500, Kotschy exsicc. n. 939.

*Asclepias gigantea* Forsk. Fl. Aeg.-Arab, p. CVIII.

*Arabic name* : Ushar.—*Persian name* : Khark.

*Description* :—An erect shrub, usually 6—8 feet high (in arid places sometimes higher) ; young parts with white cottony tomentum ; bark soft, corky, spongy. Leaves subsessile, usually  $2\frac{1}{2}$ —6 by  $1\frac{3}{4}$ — $3\frac{1}{4}$  inches, broadly ovate, ovate-oblong, elliptic or obovate, with a short, abrupt acumination.

Flowers in umbellate cymes ; peduncles 1—3 inches long, lateral ; pedicels  $\frac{1}{4}$  inch long ; buds globose. Calyx divided to the base ; sepals  $\frac{1}{5}$  by

$\frac{1}{10}$  inch long, ovate, acute. Corolla glabrous, about 1 inch across; lobes usually erect, ovate, acute,  $\frac{3}{8}$  inch long; corona-lobes compressed, equaling or exceeding the staminal column, the back nearly straight or sometimes slightly curved away from the column above the upcurved sub-acute spur, the apex obliquely truncate, bifid and without auricles.

Follicles 3—4 by 2—3 inches, subglobose, ellipsoid or ovoid. Seeds  $\frac{1}{4}$  by  $\frac{1}{6}$  inch, broadly ovate, acute, flattened, narrowly margined, minutely tomentose, light-brown; coma  $1\frac{1}{4}$  inches long.

*Flowers*:—October (Marchesetti); March 1878 (Perry); April 1888 (Lunt).

*Fruits*:—April 1844 (Lunt).

*Locality*:—Plain of Maala (Defl., Schweinf., Lunt); great valley between Steamer Point and town (Marchesetti); without locality (Birdw.); not uncommon on N. stony plains (Perry); Steamer Point, nearly sea level, near telegraph station (Lunt); Shaikh O'thman (Ellenbeck).

*Distribution*:—Tropical Africa, Egypt, Syria, Arabia, Persia, Afghanistan, Sind, Punjab and in the subhimalayan tract east to the Sarda river, drier districts of the Deccan, dry region of the Irawady valley.

*Note*:—No mention is made of this plant in the 'Florula Adenensis.' It seems strange that all the botanists before Anderson and Anderson himself should not have noticed this tall conspicuous shrub. We are inclined to believe that our *Calotropis* did not exist in Aden about 50 years ago; it is quite possible that it was carried there by the Arab boats which land quite close to the place where this milky bush is found in abundance.

*Historical Note*:—Prosper Alpinus was one of the earliest European writers to describe this plant (De Plantis Aegypti, 1592, c. XXV). He tells us that it is the 'beidelsar' of Alexandria, where it grows in damp places. The ancient Arabs seem to have had superstitious beliefs regarding this plant, since they associated it with sun-worship. The Arabic name 'ushar' appears to be a generic word for milk-yielding plants and was probably restricted to *Calotropis* at a comparatively late date. Abu Hanifeh was perhaps the first Arab writer to give an explicit account of it (Watt, Comm. Prod. Ind. p. 205).

With certain Hindus *Calotropis* is a sacred plant, and is associated with the observances of the 'maruts' or winds, the demigods of 'rudra.'

For further details cf. Ibn-el-Beithar, II, p. 267, 448; Rheede Hort. Mal. 1679, II, t. 31; Rumphius Herb. Amb. 1755, VII, 24, t. 14, f. 1; Jones in Asiat. Res., 1798, IV, 267; Joret, Les Plantes dans L'Antiq. 1904, II, 354.

For economic uses (gutta-percha, fibre, floss, medicine) cf. Watt, Dict. Econ. Prod. Ind. II, 33-49; Comm. Prod. Ind. 205-208.

### 3. *Pentatropis* R. Br.

Slender twiners with opposite petiolate leaves, and sublateral or subaxillary umbels of small flowers.

Calyx 5-partite. Corolla 5-lobed nearly to the base. Lobes suberect, with spreading tips, overlapping to the left and more or less twisted to the right in bud. Corona simple, arising from the staminal column, of 5 laterally compressed lobes, adnate for half to two-thirds of their length to the backs of the anthers. Staminal column arising from the base of the corolla. Anthers with membranous appendages inflexed over the truncate apex of the style. Pollen-masses pendulous, solitary in each cell of the anthers, affixed in pairs by short slender caudicles to the pollen-carriers.

Follicles lanceolate, narrowed into a beak, smooth. Seeds crowned by a tuft of hairs.

*Species* about 6.

*Distribution* :—Through Africa, Arabia, Baluchistan, the drier parts of India into China and the Malay Archipelago.

**1. *Pentatropis cynanchoides* R. Br.** in Salt Voy. Abyss. Append. LXIV ; This.-Dyer Fl. trop. Afr. IV, 380, Cooke Fl. Bomb. Pres. II, 154.

*Pentatropis spiralis* Dene. in Ann. Sc. Nat. 2 sér. IX, 327, t. 11, fig. E et in DC. Prodr. VIII, 536 ; Engl. & Prantl Pflanzenf. IV, 2, 251, fig. 73, P—Q, and 258 ; Penzig in Atti Congr. Bot. Internaz. (1892) 349.

*Pentatropis spiralis* Dene., *var. longepetiolata* Engl. Hochgebirgsfl. Trop. Afr. 343.

*Tylophora cirrosa* Aschers. in Schweinf. Beitr. Fl. Aethiop. 132.

*Description* :—Stems slender, twining, glabrous, except in the axils of the leaves and at the base of the young shoots, which are more or less pubescent. Leaves spreading ; petiole 1—4 lines long ; blade  $\frac{1}{2}$ — $1\frac{1}{2}$  inches long,  $\frac{1}{4}$ —1 inch broad, oblong, ovate or elliptic-ovate, acute or obtuse, mucronate, more or less fleshy, glabrous.

Umbels subaxillary, 3—6-flowered ; peduncles slender, 1—3 lines long, or sometimes almost absent ; pedicels 3-5 lines long, filiform, sparsely puberulous. Sepals  $\frac{1}{2}$ — $\frac{3}{4}$  lines long, ovate, acuminate, sparsely puberulous, or subglabrous. Corolla pentagonal and acuminate in bud, 5-lobed nearly to the base, lobes 4—5 lines long, narrowly linear from a triangular base, twisted in bud, glabrous outside, minutely puberulous within. Corona-lobes arising  $\frac{1}{2}$  line above the base of the staminal column and nearly or quite reaching to its apex, varying in different



flowers in the same umbel,  $\frac{1}{2}$  line long, compressed, subtriangular in outline viewed sideways, subtruncate at the base, adnate to the column for  $\frac{2}{3}$  of their length, with a free narrowly oblong subacute or acute apex.

Follicles 2—3 inches long and about  $\frac{1}{3}$  inch thick, lanceolate, acuminate into a beak, smooth, glabrous.

*Locality* :—Shaikh O'thman (Defl.).

*Distribution* :—S. Arabia (Lahadj, El Hadjar, Shonkra), Dahlak Island in the Red Sea, Nubia, Eritrea, Abyssinia, drier parts of India.

#### 4. *Steinheilila Dcne.*

A perennial herb, the rhizome giving off one or two leafy stems. Leaves rosulate, petiolate, cordate or rotundate-cordate, mucronate, hoary, reticulately veined; primary leaves subreniform.

Flowers umbellate, violet. Calyx 5-partite. Corolla campanulate, 5-fid; throat with 5 emarginate scales; at the base of the tube 5 pits with alternate scales. No staminal corona. Gynostegium included in the tube, covered at the apex with scales, stipitate, striate. Anthers with 2 lateral, cartilaginous, black horns, which are united with the corpuscles of the stigma, at the apex with an oblong membrane. Pollen-masses subcompressed, clavate, pendulous. Stigma muticous.

Follicles ovoid, rostrate at the apex, fleshy, smooth; seeds comose.

*Species* 1.

1. *Steinheilila radians* (Forsk.) Dcne. in Ann. Sc. Nat. ser. II, IX, 339; Anders. Journ. Linn. Soc. V, Suppl. p. 24.

*Asclepias radians* Forsk. Fl. Aeg.-Arab. p. 49.

*Description* :—Leaves lurid-green, violaceous on the lower surface, 1 inch long,  $1\frac{1}{2}$  inches broad; petiole  $\frac{1}{2}$  inch long.

Peduncles axillary, solitary, multiflowered, tomentose, 1—2 inches long. Pedicels short. Calyx-segments lanceolate, incano-hirsute. Corolla 5 lines long, twice as long as the calyx, glabrous; lobes erect, lanceolate, acute, contorted.

Follicles solitary by abortion.

*Flowers* :—January 1880 (Balfour), March 1878 (Perry), April 1861 (Thomson), April 1894 (Lunt), May 1859 (Anderson), May 1873 (Hildebrandt), June 1872 (Hildebr.).

*Fruits* :—June 1872 (Hilderbr.).

*Locality* :—Plain of Maala (Schweinf.); on the south-western slope of the Shum Shum Range (Defl.); great valley between Steamer Point and town (Marchesetti); in sandy places, very rare (Anderson); Plain of Maala, nearly sea-level (Lunt); in sandy places (Perry); in loco saxoso

(Hildebrandt); neighbourhood of Aden (Hunter); without locality (Thomson, Oliver & Cl., Balfour).

*Distribution*.—Yemen, Somaliland (Herb. Kew).

*Uses*.—The unripe follicles are edible (Hildebr.).

### 5. *Dæmia* R. Br.

Twining pubescent or tomentose perennial herbs or undershrubs. Leaves opposite, cordate.

Flowers medium-sized, in lateral racemose or corymbose pedunculate cymes. Calyx 5-partite, glandular inside. Corolla yellowish-or greenish-white; tube short, campanulate or cylindric; lobes 5, ovate, spreading, overlapping to the right in bud; corona double, the outer at the base of the staminal column, membranous, annular, shortly 5-lobed, the lobes subquadrate or oblong, obtuse, truncate or denticulate, the inner corona of 5 erect fleshy lobes spurred at the base, adnate to the staminal column up to the anthers, free above and produced into subulate horns incurved over the style-apex. Staminal column arising at the mouth of the corolla-tube; anthers erect, with a membranous inflexed appendage. Style-apex exserted; pollen-masses waxy, 1 in each anther-cell, compressed, attached in pairs to the pollen-carriers by their attenuated ends without caudicles.

Follicles lanceolate, usually echinate. Seeds comose.

*Species* 6.

*Distribution*.—Tropical Africa, tropical and subtropical Asia.

**1. *Dæmia cordata* (L.) R. Br.** Wern. Soc. I, 50; Boiss. Fl. Or. IV, 60; This.-Dyer Fl. trop. Afr. IV, 386; Batt. et Trab. Fl. d'Alg. II, 586.

*Pergularia tomentosa* L. Mant. p. 53.

*Asclepias cordata* Forsk. Fl. Aeg.-Arab. p. 49.

*Dæmia incana* Dene. Ann. Sc. Nat. ser. II, II, 336.

*Dæmia tomentosa* Pomel Nouv. Mat. Fl. Atl. 82; Vatke in Oest. Bot. Zeitschr. (1876) 146.

*Arabic name*.—*Demia*.

*Description*.—Stems shortly tomentose, with or without a mixture of long hairs, sometimes slightly hispid. Leaves deflexed; petiole  $\frac{1}{6}$  —  $\frac{3}{4}$  inch long; blade  $\frac{1}{2}$  —  $1\frac{1}{4}$  inches long, 5 lines to  $1\frac{1}{2}$  inches broad, cordate-orbicular or cordate-ovate, apiculate or shortly cuspidate, rather thick, tomentose on both sides.

Flowers in a corymb-like raceme, which (including the peduncle) is 1—2 inches long, tomentose or shortly and softly hairy, as are also the  $\frac{1}{3}$  — 1 inch long pedicels, and the 1—2 lines long ovate acute

sepals. Corolla-tube  $1\frac{1}{2}$ —2 lines long; lobes 3— $3\frac{1}{2}$  lines long, oblong-ovate, acute, bearded along their margins. Outer coronal lobes  $\frac{1}{2}$  line long, subquadrate or oblong, obtuse, truncate or denticulate. Inner coronal lobes rarely exceeding  $2\frac{1}{2}$  lines in length, fleshy, white, lanceolate, attenuate into subulate entire or bifid points, with a spur about  $\frac{1}{3}$  line long, arising below the middle of the staminal column.

Follicles  $1\frac{1}{2}$ — $2\frac{1}{2}$  inches long, ovoid, acuminate into a beak, more or less echinate, sometimes nearly smooth, minutely tomentose. Seeds  $\frac{1}{3}$  inch long,  $\frac{1}{4}$  inch broad, nearly flat, ovate, margined, minutely tomentose on both sides.

*Locality* :—Little Aden, at the foot of the north-eastern slope of the Jebel Muzulghum (Defl.).

*Distribution* :—Central and Southern Arabia, Nubia, Syria, Baluchistan.

### 6. *Caralluma* R. Br.

Succulent perennial herbs, branching, leafless. Stems 3—6-angled, thick and fleshy, obtusely tubercled or acutely toothed along the angles.

Flowers in few- or many-flowered fascicles or sessile umbels at the base, apex, or along the sides of the stems between the angles, small or of moderate size, pedicellate or subsessile. Calyx 5-partite. Corolla rotate, broadly cup-shaped or with a distinct campanulate or subglobose tube, 5-lobed; lobes varying from broadly ovate to linear-attenuate, valvate in bud. Corona double, arising from the staminal column; outer corona sometimes annular or cup-shaped, entire, crenulate, denticulate, 5—10- (rarely 20-) toothed or lobulate, adnate to the backs of the inner coronal lobes at their base or connected to them by narrow partitions; sometimes of 5 lobes more or less adnate by their margins to the sides or backs of the inner coronal lobes forming 5 small pouch-like cavities alternating with the anthers, or spreading, rarely quite free to the base, usually more or less bifid, sometimes so deeply that the whole corona (inner and outer) appears to consist of 5 trifid lobes; inner coronal lobes incumbent on the backs of the anthers and not longer than them, or produced into erect connivent or recurved tips, with or without a dorsal tooth or horn near or at their base, where they are dorsally connected with the outer corona. Staminal column arising from the bottom of the corolla, short; anthers horizontally inflexed or ascending, not appendaged. Pollen-masses horizontal or ascending, solitary in each anther-cell, pellucid along the inner margin or at the apex, attached to the pollen-carriers in pairs by short and rather slender caudicles; pollen-carriers with or without a wing-like expansion on each side, black or brown. Style not produced beyond the anthers, truncate at the apex.

Follicles narrowly fusiform, linear-terete or trigonous, smooth. Seeds crowned with a tuft of hairs.

*Species* about 40.

*Distribution* :—S. Europe, Africa, Arabia, India.

Flowers in dense globose heads at the ends of the branches . . . 1. *C. adenensis*.

Flowers in terminal multiflowered umbels . . . 2. *C. Forskalii*.

1. *Caralluma adenensis* (Defl.) K. Schum. in Engl.-Prantl Pflanzenfam. IV, 2, 277.

*Boucerosia adenensis* Defl. Mém. de l'Inst. d'Egypte III, 270.

*Description* :—A herb,  $1\frac{1}{2}$ —2 feet high and more, thick-fleshy, juicy, pale-green, branching; branches robust, erect, 4-gonous, the younger ones subclavate, the old ones equally thickened, the angles obtusely sinuate-crenate, prominulous, or even subwinged, with concave faces, at last plane.

Flowers 25—40 together, intermixed with numerous bracts, forming dense globose heads at the ends of the branches. Bracts narrowly linear; pedicels pale-green, terete, glabrous, often half as long as the flowers. Calyx pale-green, with a very short tube, obsoletely 5-costate; laciniae linear, elongate, 3-nerved, shortly revolute at the apex, papillose-glandular on the outer side. Corolla lurid, glabrous, virescent on the outer side, atro-purple on the inner, often verrucose; tube campanulate, abruptly expanded into a plano-convex limb; lobes deltoid, acuminate, shorter than the tube; corona slightly fleshy, rose-coloured, pubescent, arising from the base of the corolla, lower part cyathiform, 5-locellate by radiant septa which are attached to the staminal tube, double; outer lobes erect, subinflexed, long-bicornute; horns linear, obtuse, scarcely arcuato-divaricate, pubescent on both sides; inner lobes arising from the sinuses, introflexed, liguliform, glabrous, free at the apex, longer than the anthers.

Follicles in pairs, involucrate by the marcescent coriaceous calyx, 7—8 inches long,  $\frac{1}{5}$ — $\frac{1}{3}$  inch broad, terete, very long attenuate-acuminate, subuncinate at the apex, smooth-glabrous. Seeds complanate, ovate, comose, with a narrow membranous wing and thickened marginal ring.

*Flowers* : December 1888 (Schweinf.).

*Fruits* : April 1861 (Thomson).

*Locality* :—Shum Shum Range (Defl.); near Maala, Goldmore Valley (Schweinf.); without locality (Thomson).

*Distribution* :—Yemen.

*Note* :—Deflers says that the flowers are sometimes quite inodorous, and that, at other times, they exhale an offensive odour of decaying flesh.

Carnivorous flies are attracted by the smell and deposit their larvæ in the corolla-tube. It is probable that, by doing so, they are the agents of pollination, carrying the pollinia of one plant to another.

**2. Caralluma Forskalii** (Dene.) K. Schum. in Engl.-Prantl. Pflanzenfam. IV, 2, 277.

*Boucerosia Forskalii* Dene. Prodr. VIII, 648 ; Defl. Mém. de l'Inst. d'Egypte III, 270.

*Boucerosia cicatricosa* Defl. Voy. Yemen, p. 170, tab. IV.

*Desmidorchis*, Ehrenberg in Linnæa 1829, p. 24.

*Arabic name* :—Dra el Kelb, Kousma (Schweinf.).

*Description* :—Branches acutely tetragonous ; angles obtusely calloso-dentate ; callosities orbicular.

Umbels terminal, multi-flowered. Flowers very short-pedicelled. Corolla-lobes densely verrucose glabrous.

Follicles linear-oblong, subangular.

*Locality* :—Goldmore Valley (Defl.) ; without locality (Balfour).

*Distribution* :—Yemen : Mount Saber.

## 7. *Kanahia* R. Br.

Shrubs with straight erect branches and milky juice. Leaves opposite, linear-lanceolate or linear, with minute bristles in their axils.

Inflorescence lateral at the nodes, with the peduncles racemously scattered along the upper part of the branches. Flowers spirally arranged around the slightly thickened apical part of the peduncle, which becomes more or less elongated into a flowering axis, pedicellate, bracteate, developing successively, never strictly umbellate. Calyx 5-partite. Corolla 5-lobed to half-way down or nearly to the base ; lobes ascending, spreading or reflexed, slightly overlapping to the left in the bud. Corona of 5-lobes arising from the staminal-column, either very thick and fleshy, solid and produced into a short horizontally inflexed subulate entire or bifid beak at the apex, or more or less complicate or cleft down the inner face. Staminal column arising from the bottom of the corolla ; anthers erect, with membranous appendages inflexed over the apex of the style. Pollen-masses pendulous, solitary in each anther-cell, attached in pairs to the pollen-carriers by short horizontal caudicles. Apex of the style with a convex central boss surrounded by a depressed ring and with 5 very minute tubercles close to the pollen-carriers.

Follicles fusiform-lanceolate or somewhat ovoid, not echinate.

*Species* 4.

*Distribution* :—Tropical Africa, extending to Arabia.

1. *Kanahia laniflora* R. Br. in Mem. Wern. Soc. I, 40; K. Schum. in Engl. & Prantl. Pflanzenfam. IV, II, 233, not of Decne.; Brown in This-Dyer Fl. trop. Afr. IV, sect. I, 296.

*Kanahia Delilii* Decne. in Ann. Sc. Nat. sér. 2, IX, 330, in DC. Prodr. VIII, 537; A. Rich. Tent. Fl. Abyss. II, 34; Engl. Hochgebirgsfl. Trop. Afr. 342; Schweinf. in Höhnelt, Zum Rudolf-See u. Stephanie-See, Separatabdr. 8; Schweinf. & Volkens Liste Pl. Somalis 10; Martelli Fl. Bogos. 54; Penzig in Atti Congr. Bot. Internaz. 1892, 349; K. Schum. in Engl. Pfl. Ost-Afr. C. 323, in Engl. & Prantl. Pflanzenfam. IV, II, 233, et in Ann. Istit. Bot. Roma. VII, 37.

*Asclepias laniflora* Forsk. Fl. Aegypt.-Arab. 51; Vahl Symb. I, 23, t. 7; Delile Cent. Pl. Voy. Méroé, 49, t. 3, fig. 3.

*Description*.—Stem 4—6 feet high, branching, glabrous. Leaves ascending or somewhat spreading, with a cluster of short bristles or teeth in their axils and along the rudimentary stipular line connecting their bases; petiole  $1\frac{1}{2}$ —3 lines long; blade  $2\frac{1}{2}$ —6 inches long, 2—6 lines broad, lanceolate or linear-lanceolate, gradually tapering to an acute point, acutely narrowed into the petiole, quite glabrous, not revolute at the margin.

Peduncles 1—2 inches long, rather stout, glabrous, lateral at the nodes, many-flowered at the apical part, which becomes raceme-like from the gradual development of the flowers; lowest bracts 2—9 lines long, the rest  $1\frac{1}{2}$ —3 lines, linear or subulate, acute, glabrous, mostly with minute bristle-like teeth at their base, like those in the leaf-axils; pedicels  $\frac{1}{2}$ —1 inch long, glabrous. Sepals 2—3 lines long, lanceolate, acuminate, glabrous. Corolla 7—9 lines in diameter, campanulate, 5-lobed to half-way down or beyond; lobes 4—5 lines long, ascending, ovate, acute, glabrous outside, more or less densely woolly within along the borders. Coronal lobes arising  $\frac{3}{4}$  lines above the base of the staminal column and reaching to its summit, 2 lines long, erect, stout, turgid-oblong, fleshy, solid, not in the least complicate, abruptly contracted at the apex on the inner side into a simple or bifid subulate tooth or beak, inflexed over the tips of the anthers. All the lobes are connected to one another at their base by very obtuse minute flaps that form five pockets, enclosing the basal parts of the anther-wings. Staminal column  $2\frac{3}{4}$ —3 lines long; anther-appendages broadly subcordate-ovate, obtuse, inflexed over the apex of the style. Pollen-masses (excluding the caudicles)  $\frac{1}{4}$  line long,  $\frac{1}{8}$  line thick, turgid, not compressed.

Follicles 2— $2\frac{1}{2}$  inches long, lanceolate, acuminate into a beak, glabrous, scrobiculate, but not echinate. Seeds 2 lines long, ovoid, tapering into

a short beak, channelled on one side, very turgid on the other, smooth, crowned with a tuft of hairs.

*Locality*:—"Neighbourhood of Aden, common near water" (Hunter).

We are not sure whether this plant has been found on British territory.

*Distribution*:—Arabia, Eritrea, Galabat, Abyssinia, Somaliland, German East Africa.

### XXXI.—BORAGINACEÆ.

Herbs, shrubs, or trees, with usually alternate leaves.

Inflorescence normally a dichotomous cyme with helicoid branches, sometimes a simple unilateral raceme or spike or an irregularly trichotomous panicle. Flowers hermaphrodite, usually regular, hypogynous, and pentamerous. Calyx-tube campanulate or cylindric; lobes 4—5 (rarely 6—8). Corolla various, usually 4—5-lobed; lobes mostly imbricate. Stamens as many as the corolla-lobes, epipetalous; filaments filiform or dilated at the base, sometimes with a basal scale; anthers various, dorsifixed, more or less bilobed at the base, introrsely or laterally dehiscent. Disk annular, entire or 5-lobed, sometimes inconspicuous. Ovary superior, confluent at the base with the disk, entire or more or less completely 2—4-lobed, 2-celled and 2-ovulate or 4-celled and 1-ovulate; ovules erect or attached to the inner angle of the cell; style terminal in the entire, gynobasic in the lobed ovary; stigma terminal or annular, entire or bilobed.

Fruit drupaceous or dividing into 2—4 nutlets. Seeds erect, oblique or almost horizontal, straight or curved; testa membranous; albumen copious, scanty or 0; embryo straight or curved; cotyledons flat, plano-convex or thick and fleshy, usually entire; radicle usually much shorter than the cotyledons.

*Genera* about 85. *Species* about 1,200.

*Distribution*:—Tropical and temperate regions, specially Mediterranean.

Style terminal on the ovary . . . . . 1. *Heliotropium*.

Style inserted between the 4 lobes of the ovary:

Flowers regular . . . . . 2. *Arnebia*.

Flowers irregular . . . . . 3. *Echiochilon*.

#### 1. *Heliotropium* Linn.

Herbs, undershrubs or shrubs with usually alternate leaves.

Flowers often unilateral along the branches of terminal scorpioid symes, sometimes all axillary or arranged in simple leafy racemes

Calyx 5-cleft; lobes linear or lanceolate. Corolla-tube cylindric, usually naked at the throat; lobes 5, imbricate or induplicate. Stamens 5, epipetalous, included. Ovary completely or imperfectly 4-celled, 4-ovulate; ovule pendulous from the inner angle of the cell near its apex; style terminal, usually with a depressed conic or broad stigmatic ring below the apex.

Fruit somewhat fleshy, 2- or 4-sulcate or -lobed, at length dividing into 4 distinct or geminately cohering nutlets. Seeds straight or curved; albumen usually scanty; cotyledons plano-convex; radicle short.

*Species* about 220.

*Distribution*:—Tropical and temperate zones.

Corolla-lobes distinctly caudate . . . . .	2. <i>H. zeylanicum</i> .
Corolla-lobes not caudate	
Annuals . . . . .	3. <i>H. pterocarpum</i> .
Perennials	
Stigma with two long arms . . . . .	4. <i>H. ophioglossum</i> .
Stigma with a conical crest	
Spikes ebracteate	
Spikes many-flowered, at length lax . . . . .	1. <i>H. strigosum</i> .
Spikes few-flowered, dense	
Style-arms very unequal . . . . .	8. <i>H. paradoxum</i> .
Style arms not so . . . . .	7. <i>H. undulatum</i> .
Spikes bracteate	
Spikes short, dense, 3—6-flowered . . . . .	5. <i>H. lignosum</i> .
Spikes subelongate, lax . . . . .	6. <i>H. adenense</i> .

**1. *Heliotropium strigosum*** (Forsk.) Willd. Sp. Pl. I, 743; DC. Prodr. IX, 546; Anders. Journ. Linn. Soc. V, Suppl. p. 25; Boiss. Fl. Or. IV, 143; Hook. Fl. Brit. Ind. IV, 151.

*Heliotropium brevifolium* Wall Cat. 914; DC. Prodr. IX, 546.

*Heliotropium tenue* Wall. (ex Anders.).

*Heliotropium fruticosum* Forsk. Fl. Aeg.-Arab. p. 38.

*Heliotropium parvifolium* Edgw. Journ. As. Soc. Beng. XVI, 1216.

*Heliotropium bicolor* Hochst. et Steud. in Schimp. Pl. Abyss. n. 569.

*Heliotropium tenuifolium* R. Br. Prodr. 494.

*Arabic name*:—Hhashfe.

*Description*:—Perennial. Root more or less thick and woody. Stem slender, much branched, clothed with adpressed white bristly hairs. Leaves linear or linear-lanceolate, sessile or very shortly stalked, up to  $1\frac{1}{4}$  inches long, usually much smaller, with adpressed bristly hairs on both surfaces, revolute at the margins.

Spikes very lax, finally 3 inches long; lower flowers often shortly pedicellate and bracteate. Calyx 1 line long, hairy outside; lobes from



linear to lanceolate. Corolla-tube a little longer than the calyx, slightly swollen about the middle; lobes  $\frac{1}{3}$  line long, ovate, obtuse, crisped. Stamens inserted about the middle of the corolla-tube; anthers ovate, obtuse, crisped. Ovary globose; style  $\frac{1}{4}$  line long, glabrous; stigma shortly conical, persisting on the young fruit.

Fruit depressed, obtusely 4-lobed,  $\frac{1}{2}$  line long, hirsute above, separating into 4 nutlets, rounded not angled on the back.

*Flowers* :—January 1863 (Oliver and Cl.), February (Madden), March 1878 (Perry), November 1888 (Schweinf.), December 1847 (Hooker).

*Fruits* :—December 1847 (Hooker).

*Locality* :—Goldmore Valley, plain of Maala, Shum Shum Range (Schweinf.); plain of Maala, crater of Shum Shum Range (Defl.); from the sea-shore to the top of the Shum Shum Range (Edgw., Hook., Anders.); great valley between Steamer Point and town (Marchesetti); slope of Shum Shum Range (Hildebr.); without locality (Birdw., Perry, Madden, Oliver and Cl.).

*Distribution* :—Tropics of the Old World.

**2. *Heliotropium zeylanicum* Lam.** *Encycl.* III, 94 (not of Wall.); *Hook. Fl. Brit. Ind.* IV, 148.

*Heliotropium paniculatum* Heyne in *Herb. Rottler*.

*Tournefortia subulata* Hochst. in *DC. Prodr.* IX, 528.

*Heliotropium subulatum* Hochst. *Nub. n.* 163 and in *DC. Prodr.* IX, 523.

*Tournefortia royleana* *DC. Prodr.* IX, 527.

*Tournefortia edgeworthii* *DC. Prodr.* IX, 529.

*Tournefortia zeylanica* *Wight. Ill. t.* 170.

*Messerschmidia hispida* *Benth. in Royle Ill.* 360.

*Heliotropium curassavicum* *var. zeylanicum* *Burm. Flor. Ind.* 41, t. 16, f. 2.

*Description* :—An erect annual, 1—3 feet high, scabrous and coarsely hairy with stiff hairs arising from white bulbous bases, the globose bases showing distinctly in dried specimens. Leaves 1—2 by  $\frac{1}{8}$ — $\frac{1}{2}$  inch, sessile or nearly so, lanceolate, acute, entire, densely clothed with stiff hairs arising from white bulbous bases, base tapering.

Flowers sessile, in elongate spikes 2—6 inches long, usually in one rank along the rhachis, but sometimes, especially towards the apex of the spike, 2-ranked. Calyx  $\frac{1}{10}$  inch long, hairy on both sides, divided to the base; sepals ovate, acute, densely ciliate. Corolla-tube  $\frac{1}{6}$ — $\frac{1}{5}$  inch long, the upper half slightly swollen and setose outside; lobes  $\frac{1}{10}$ — $\frac{1}{8}$  inch long, caudate-acuminate, spreading. Stamens inserted in the

swollen part of the corolla, surrounding the style; anthers sessile, ovate-oblong, bifid at the apex. Style glabrous,  $\frac{1}{12}$  inch long; stigma  $\frac{1}{16}$  inch long, the stigmatic ring surmounted by a long cone which is penicillate at the apex with erect white glistening hairs.

Nutlets 4, ovate in longitudinal section,  $\frac{1}{12}$  inch long, slightly incurved, rounded and rugose or tuberculate on the back, cuneate on the inner face, 2-seeded.

*Locality* :—South-eastern slope of the Shum Shum Range (Defl.) ; without locality (Birdw.).

*Distribution* :—Tropical Africa, Central and S. Arabia, W. India from the Punjab to the W. Deccan Peninsula.

**3. *Heliotropium pterocarpum*** Hochst. et Steud. in Schimp. Pl. Abyss. n. 835; DC. Prodr. IX, 552; Bunge, Monogr. Heliotr. p. 53.

*Heliotropium pterocarpum* DC. Prodr. IX, 552.

*Description* :—An annual. Stems short, spreading, slender, densely clothed with whitish bristly hairs. Leaves small, oblong, sessile or shortly petioled, thick, crisped on the margin, densely hispid on both sides.

Spikes short, ebracteate, very dense, much curved. Calyx densely hispid, 2 lines long; tube short; lobes oblong, free nearly to the base, or more or less united, 3 lines long. Corolla-tube narrowly campanulate; lobes small, orbicular. Stamens inserted just below the middle of the corolla-tube; anthers oblong. Stigma conical, as long as the glabrous style, together 1 line long.

Nuts glabrous, cohering in pairs, margined with a broad horny wing, with a rounded sinus at the apex.

*Flowers* :—January 1863 (Oliver & Cl.).

*Locality* :—Goldmore Valley (Schweinf.); without locality (Birdw., Oliver & Cl.); Shaikh O'thman (Defl.).

*Distribution* :—Yemen, Socotra, Eritrea, British Somaliland.

**4. *Heliotropium ophioglossum*** Stocks ex Aitch. Cat. Pl. Punjab p. 94; Boiss. Fl. Or. I, 145; Hook. Fl. Brit. Ind. IV, 149.

*Heliotropium stylosum* Franch. Sert. Somal. in Miss. Révoil. p. 45, tab. 4.

*Description* :—An undershrub, 6—15 inches high, branched from near the base; stems and branches hoary with soft hairs and also clothed with stiff hairs arising from white bulbous bases. Leaves  $\frac{3}{4}$ — $1\frac{1}{2}$  by  $\frac{1}{4}$ — $\frac{1}{2}$  inch, densely hirsute with stiff hairs and also clothed with a softer pubescence; the lower leaves petiolate, elliptic, acute, running down into the petiole; the upper leaves sessile, lanceolate, acute, all with subentire, undulate margins.

Flowers sessile, distant, 1—2-ranked, in simple geminate or ternate densely hairy spikes 2—6 inches long. Calyx divided almost to the base, hairy; segments 5, linear, acute, ciliate. Corolla slightly exerted beyond the calyx; tube cylindric, slightly pubescent outside, the throat plicate; lobes 5, broadly ovate or suborbicular, obtuse or subacute, undulate, veined, usually with small teeth between the lobes. Stamens inserted below the middle of the corolla-tube; anthers linear-oblong, rounded at the tip. Style short; stigma shortly conical at the base, prolonged above into a long subulate appendage about  $\frac{1}{8}$  inch long, divided at the apex into 2 filiform, recurved, acute arms.

Fruit  $\frac{1}{16}$  inch long, glabrous, black; nutlets 4, rounded on the back and at their apex, 1-seeded.

*Flowers*:—March 1888 (Schweinf.), March 1878 (Perry).

*Locality*:—Above the coal-depôt of the Messag. Marit. (Schweinf.); without locality (Birdw., Lunt, Perry, Beevor).

*Distribution*:—Sind, Baluchistan, S. Arabia, S. Persia, Somaliland.

**5. *Heliotropium lignosum* Vatke in Oester. Bot. Zeitschr. (1874) p. 167; Boiss. Fl. Or. IV, 143; This.-Dyer Fl. trop. Afr. IV, sect. 2, p. 40.**

*Lithospermum lignosum* Schweinf. ex Vatke l. c.

*Description*:—Fruticose. Stems short, woody, ascending, densely clothed with short adpressed whitish bristly hairs. Leaves small, sessile, lanceolate, with revolute crisped edges, densely and shortly bristly on both sides.

Spikes short, dense, 3—6-flowered. Calyx  $1\frac{1}{2}$  inches long, very hispid; tube short; segments oblong. Corolla-tube slightly longer than the calyx, subcylindric; segments small, obtuse. Stamens inserted just below the middle of the corolla-tube. Style short; stigma conical; apex bilobed.

Nuts 4, hispid.

*Flowers*:—Dec. 1888 (Schweinf.).

*Locality*:—Near the mosque Shaikh Aidrus in the crater of the Shum Shum Range (Schweinf.).

*Distribution*:—S. Arabia, S. Persia, Nubia.

**6. *Heliotropium adenense* Gürke Herb. Berol. ex Krause Engl. Bot. Jahrb. XXXV, Heft 5, p. 51.**

*Description*:—Perennial, much-branched from the base, densely clothed with pilose hairs; lower branches woody. Leaves  $\frac{1}{3}$ — $\frac{1}{2}$  inch long,  $\frac{1}{12}$ — $\frac{1}{8}$  inch broad, sessile, pilose, revolute on the margin.

Cymes lax, subelongate; bracts linear, persistent; pedicels very short. Sepals  $\frac{1}{6}$  inch long, oblong, pilose. Corolla  $\frac{1}{5}$ — $\frac{1}{4}$  inch long; tube cylindric, slightly shorter than the calyx, contracted at the apex, pilose externally; petals reddish. Anthers on short filaments. Style included in the tube; stigma elongate-conic.

*Locality*:—On a rocky slope of the Shum Shum Range (Ellenbeck n. 126). Endemic in Aden.

*Note*:—" *H. adenense* Gürke is nearly allied to *H. strigosum* (Forsk.) Willd. and seems to approach *H. albo-hispidum* Baker Kew-Bull. 1895 p. 220 which occurs in Somaliland. Not long ago two species from Hadramaut have been described, viz. *H. congestum* Baker and *H. drepanophyllum* Baker, from which *H. adenense* is chiefly distinguished by its lax and erect inflorescence." Krause l. c.

We had no opportunity of seeing the type-specimen of this species, and the London herbaria do not contain any specimen corresponding to the above description.

7. *Heliotropium undulatum* Vahl Symb. I, 13; DC. Prodr. IX, 536; Boiss. Fl. Or. IV, 147; Hook. Fl. Brit. Ind. IV, 150; Schmidt Beitr. Fl. Cap. Verd. Ins. 225; Hiern in Cat. Afr. Pl. Welw. I, 718.

*Heliotropium crispum* Desf. Fl. Atlant. I, 151, t. 41.

*Heliotropium persicum* Lam. Encycl. III, 94; DC. l. c. 537; Boiss. Fl. Or. IV, 147.

*Heliotropium persicum* Burm. Ind. p. 41, tab. 29.

*Heliotropium ramosissimum* Sieber exsicc. Aegypt.; DC. l. c. 536.

*Heliotropium eriocarpum* Del. in Lehm. Asper. 55.

*Heliotropium nubicum* Bunge in Bull. Soc. Nat. Mosc. vol. 52, 1, p. 330.

*Heliotropium cressoides* Franch. Sert. Somal. 46.

*Heliotropium marocanum* Lehm. Asper. 56.

*Lithospermum hispidum* Forsk. Fl. Aegypt.-Arab. 38.

*Arabic name*:—Ssga 'a.

*Description*:—Perennial, much-branched. Stem slender, suberect, densely clothed with white bulbous-based bristles. Leaves scabrid on both surfaces, undulate, the upper lanceolate, sessile, the lower oblong, tapering into a short petiole, up to  $2\frac{1}{2}$  inches long and 7 lines broad.

Spikes many, short, dense, ebracteate. Calyx 1 line long, hairy outside; lobes 5, oblong, truncate, as long as the tube. Corolla  $1\frac{3}{4}$  lines long; tube slightly inflated near the middle; lobes short, rounded, much undulated. Stamens inserted about half-way up the corolla-tube; anthers lanceolate, acute. Style short, thick, globrous; stigma conical.

Fruit globose, almost 2-winged, pilose at first, finally glabrous; nutlets 4, rugose.

*Flowers* :—Dec. (Defl.).

*Locality* :—Aden (Defl.); neighbourhood of Aden (Hunter).

*Distribution* :—Extends from the Cape Verde Islands through North Africa, Arabia, Socotra and Tropical Asia.

**8. *Heliotropium paradoxum* Vatke in Oester. Bot. Zeitschr. (1875) p. 167.**

*Description* :—A perennial, shrubby, much-branched plant up to 1½ feet long; branches stout, densely setulose. Leaves of sterile branches obovate-oblong, petiole-like attenuate at the base or sessile, ½—1 inch long and up to ⅙ inch broad, slightly acute, entire; of the flowering branches small, sessile, narrow, ⅓—½ inch long and about ¼ inch broad.

Racemes few-flowered (3—5) ebracteate, dense. Flowers minute. Calyx as long as the corolla. Style-arms very unequal; stigma conical, entire.

Nutlets in pairs.

*Flowers and fruits* :—June 1872 (Hildebrandt).

*Locality* :—Shaikh O'thman, on the dunes (Hildebrandt).

*Distribution* :—Hadramaut.

*Note* :—Some botanists unite *Heliotropium paradoxum* with *H. undulatum* Vahl. It seems, however, that the reasons given by Vatke still justify *H. paradoxum* being considered as a distinct species:

“Stirps abnormis *H. lignoso* (Schweinfurth) Vatke (*Lithospermum* l. ej.) *proxima*; praeterea vero etiam *stigmatum conico apice leviter et aequaliter bilobo, id quod in ipsius Schweinfurthii exemplaribus optime videre contigit styloque terminali*; species haecce *H. undulato* Vahl *simillima* characteribusque *proxima*, sed differt ut ex *analisi optima Schweinfurthii et autopsyia mea patet, styli ramis semper valde inaequalibus. H. paradoxum ob fructus structuram Heliophytis est adnumerandum, a quibus habitu abhorret; nuculis geminatim concretis etiam ab H. lignoso differt, quod nuculas separabiles possidet.*” Vatke, l. c.

## 2. *Arnebia* Forsk.

Annual or perennial erect or diffuse hispid herbs; root often staining red. Leaves alternate.

Flowers dimorphic, yellow or violet, sessile or very shortly pedicellate, in simple racemes or spikes or slightly branched cymes; bracts foliaceous. Calyx deeply 5-fid or 5-partite; lobes lanceolate or linear, not or slightly enlarged in fruit. Corolla-tube slender, straight, the throat naked

inside ; lobes 5, imbricate, obtuse, spreading. Stamens 5, much below the mouth of the tube in the long-styled, or in the throat and  $\frac{1}{2}$  exserted in the short-styled forms ; anthers small, oblong, obtuse. Ovary deeply 4-lobed ; ovules erect, with short funicles ; style filiform, 2-partite ; stigmas capitate.

Nutlets usually 4 (rarely fewer by abortion), erect, oblong or acuminate from a broad base, rugose or more or less tuberculate ; scar basal, large, triangular, flat, shortly produced up the inner face.

*Species* about 12.

*Distribution* :—N. Africa, Western and Central Asia.

**1. *Arnebia hispidissima*** (Spreng.) DC. Prodr. X, 94 ; Boiss. Fl. Or. IV, 213 ; Clarke Journ. Linn. Soc. XVIII, 524 ; Hook. Fl. Brit. Ind. IV, 176.

*Anchusa hispidissima* Sieb. H. Aeg.

*Strobila hispidissima* G. Don Gen. Syst. IV, 327.

*Anchusa asperrima* Del. Fl. d' Eg. p. 7, N. 210.

*Dioclea hispidissima* Spreng. Syst. Veg. I, 556.

*Echiochilon hispidissimum* Tausch in Flora (1829) p. 643.

*Lithospermum hispidissimum* Lehm. Ic. t. 39.

*Toxostigma luteum* A Rich. Tent. Fl. Abyss. II, 86.

*Description* :—Annual or biennial, 3--15 inches high, diffusely branched from a woody base, clothed all over with long white spreading stiff hairs often from bulbous bases. Leaves sessile,  $\frac{3}{4}$ —2 inches by  $\frac{1}{10}$ — $\frac{1}{4}$  inch linear-lanceolate, subobtuse, clothed with stiff white hairs from bulbous bases.

Flowers dimorphic, in dense secund racemes or spikes ; pedicels very short or 0 ; bracts foliaceous,  $\frac{1}{5}$ — $\frac{1}{3}$  inch long, linear-lanceolate, densely hispid. Calyx  $\frac{1}{4}$  inch long, very hispid, divided to the base or nearly so ; segments lanceolate, acute, unequal. Corolla yellow, pubescent outside ; tube  $\frac{1}{3}$  inch long, slender, lobes  $\frac{1}{10}$  inch long, oblong, obtuse. Stamens inserted much below the mouth of the corolla in the long-styled, at or in the throat and half-exserted in the short-styled forms ; anthers  $\frac{1}{20}$  inch long, oblong ; filaments very short. Style slender, 2-partite ; stigmas small, flattened on the inside, rounded on the outside.

Nutlets 4, very small,  $\frac{1}{20}$ — $\frac{1}{16}$  inch long, triangular in horizontal cross-section, acute, tuberculate on all sides.

*Locality* :—On rocks along the path leading to the top of Shum Shum Range at a height of about 900—1,000 feet (Busse) ; without locality (Birdw.).

*Distribution* :—Egypt, Nubia, Kordofan Abyssinia, Eritrea, S. Arabia, Sind, Punjab, Upper Gangetic Plain, Rajputana.

### 3. *Echiochilon* Desf.

Perennials, with many alternate stem-leaves.

Flowers small, blue, arranged in leafy scorpioid spikes. Calyx 5-partite; segments lanceolate, 1 very small or obsolete. Corolla-tube subcylindrical, curved; throat not closed by scales; limb bilabiate, irregular; upper lip erect, obscurely 2-lobed; lower more spreading, 3-lobed. Stamens 5, included in the corolla-tube; filaments very short; anthers oblong. Ovary with 4 lobes attached to the conic gynobase; style filiform; stigma 2-lobed.

Nuts 4, ovoid. Seed straight; cotyledons entire.

*Species* 2.

*Distribution* :—Africa, Arabia, Syria.

Hispid . . . . .	E. fruticosum.
Glabrous . . . . .	E. longiflorum.

1. *Echiochilon fruticosum* Desf. Fl. Atl. I, 67, tab. 47; DC. Prodr. X, 27.

*Lithospermum divaricatum* Sieb. Herb. Palæst. Spreng. Syst. I, 543.

*Description* :—A dwarf much-branched perennial, with stems and leaves densely clothed with white bristly hairs. Leaves alternate, lanceolate, 3—6 inches long, the lower ones reflexed, the upper adpressed.

Flowers axillary, solitary, sessile, crowded towards the tip of the branchlets. Calyx 4-partite; segments  $1\frac{1}{2}$  lines long, subulate, subequal, hirsute. Corolla blue, small, tubular, bilabiate; tube as long as the calyx, subarcuate, villose; throat yellow. Upper lip longer, bilobed; lower lip subtrilobed; all the lobes rounded. Stamens 5, included in the throat; filaments very short. Anthers small, acute, versatile, bilocular, dehiscent longitudinally. Ovules 4, minute.

Seeds 4, glabrous, small, tubercular, basilar.

*Locality* :—Aden (Birdw.).

*Distribution* :—N. Africa, Egypt, Palastine, Syria, Arabia, Nubia.

2. *Echiochilon longiflorum* Benth. in Hook. Ic. Plant. Plate 1277; Gürke in Engl. & Prantl Pflanzenf. IV, 3, 130.

*Description* :—A herb, divaricate-ramose, 1 foot high, glaucescent or pale-cærulescent, quite glabrous. Leaves alternate, sessile, oblong-linear or sublanceolate, entire, thick, subfleshy, the larger ones 6—8 lines long.

Spikes terminal, 4—6 inches long, thin, unilateral. Flowers scarcely strictly axillary. Calyx unequally 4—5-partite. Corolla blue; tube 4—5 lines long, 4—5 times as long as the calyx, slightly cylindric at the base

widened at the throat, upper lip of limb erecto-patent, broad, 2 lines long, the lower lip reduced to a recurved margin. Anthers oblong-linear, included; filaments very short, attached below the middle of the tube. Style filiform; stigma small, bilobed.

Nutlets almost pyramidal, subcordate at the base, tubercular-rugose or almost muricate, attached to the conical gynobase by an areola.

*Echiochilon fruticosum* is a much more scrubby plant than *E. longiflorum*, woody at the base and very hispid. The lower lip of the corolla is also much broader and the tube shorter than in *E. longiflorum*.

*Flowers* :—March 1878 (Perry), February 1900 (Birdw.).

*Locality* :—Near Aden to the north-west (Perry); without locality (Beever, Birdw.).

Endemic in Aden.

This species was discovered by Perry in March 1878. It seems to be very rare. Perry says in a letter to Sir J. D. Hooker, dated Aden, 20th April 1878: "During a month's rambling over the N. and W. sides of Aden, I have only seen one solitary specimen of this plant." Herb. Kew.

### XXXII.—CONVOLVULACEÆ.

Herbs or shrubs, often twining, with alternate petiolate, usually exstipulate leaves.

Flowers regular, usually hermaphrodite, solitary or in pedunculate axillary bracteate cymes. Calyx free, 5-partite. Corolla campanulate, infundibuliform or rotate, often plicate in bud, entire or shortly lobed. Stamens 5, epipetalous; anthers 2-celled, dorsifixed, linear or oblong, dehiscing longitudinally. Ovary superior, 1—4-celled, rarely with almost distinct carpels; ovules 2, less commonly 1—4 in each cell; style filiform, simple or forked; stigma capitate, 2-lobed or 2 stigmas.

Fruit various. Seeds as many as the ovules or fewer; albumen scanty or 0; cotyledons usually broad and much folded.

*Genera* 42; *species* about 800.

*Distribution* :—Throughout the world.

Style filiform

Stigmas 2, filiform . . . . . 1. *Convolvulus*.

Stigma capitate . . . . . 3. *Ipomœa*.

Styles 2, distinct from the base (in the species described) . 2. *Breweria*.

#### 1. *Convolvulus* L.

Herbs or shrubs, with climbing, prostrate or erect stems. Leaves simple.



Flowers solitary, in few-flowered cymes or in dense involucrate heads. Sepals generally subequal, obtuse or acute. Corolla funnel-shaped, colour various, midpetaline areas not well defined, passing gradually into the sepaline areas. Stamens inserted low down in the corolla-tube; filaments generally unequal, filiform. Ovary 2-celled, 4-ovuled; style filiform; stigmas two, filiform.

Capsule 2-celled, usually 4-valved, 4-seeded. Seeds black or brown, glabrous, or pubescent, sometimes tuberculate; cotyledons broad, plicate.

*Species* about 160.

*Distribution*:—In the temperate and subtropical regions of both hemispheres; rarer in the tropics.

Calyx up to 5 lines long	.	.	.	.	.	1. <i>C. glomeratus</i> .
Calyx 1 line long or slightly longer	.	.	.	.	.	2. <i>C. sericophyllus</i> .

**1. *Convolvulus glomeratus*** (Hochst.) Chois. in DC. Prodr. IX, 401; Anders. Journ. Linn. Soc. V, Suppl. p. 24; Clarke in Hook. Fl. Brit. Ind. IV, 219.

*Convolvulus arabicus* Hochst. in Schimp. exsicc. II (1843), n. 784.

*Ipomœa auricoma* A. Rich. Tent. Fl. Abyss. II, 67.

"*Convolvulus capitatus* Vahl" in Schimp. Pl. n. 731 et 784, *non* *C. capitatus* Vahl (ex Anders.).

*Arabic name*:—Lu.

*Description*:—Perennial. Stems many from the hard woody base, long, slender, terete, trailing or twining, finely hairy, often scabridulous. Leaves lanceolate to oblong-lanceolate,  $\frac{1}{4}$ –1 inch long, base slightly cordate, flattened or obscurely cuneate, apex obtuse to acute, mucronulate; sparsely adpressed pilose on both surfaces; petiole very short.

Flowers in dense globose bracteate ferruginously hairy heads, on slender peduncles which are generally shorter than the leaves; outer bracts large, foliaceous, up to 8 lines long, inner smaller, lanceolate, acute, a little longer than the calyx. Sepals ovate-lanceolate, up to 5 lines long, the two outer much larger than the inner, densely clothed with bright brown hairs. Corolla pinkish-white, hairy, 6 lines long.

Capsule globose, glabrous,  $2\frac{1}{2}$  lines in diameter, pale-brown. Seeds blackish-brown, scabrid.

*Flowers*:—February 1851 (Thomson), March 1878 (Perry), April 1894 (Lunt), Nov. 1888 (Schweinf.), Dec. 1847 (Hooker), Dec. 1889 (Deff.).

*Fruits*:—January 1880 (Balfour), March 1878 (Perry).

*Locality*:—Valley near Maala, Goldmore Valley (Schweinf.); Steamer Point, 200 feet (Lunt); plain of Maala (Deff.); Shum Shum Range (Ellenbeck); great valley between Steamer Point and town.

(Marchesetti) ; without locality (Edgew., Hook., Birdw., Perry, Balfour).

*Distribution* :—Abyssinia, Nubia, Eritrea, Socotra, S. Arabia, Baluchistan, Afghanistan, Sind, Punjab.

**2. *Convolvulus sericophyllus*** Anders. Journ. Linn. Soc. V, Suppl. p. 25 ; Hallier f. in Engl. Jahrb. XVIII, 97.

*Convolvulus somalensis* Franch. Sert. Somal. p. 43 (*non* Vatke).

*Convolvulus acicularis* Vatke in Linnæa vol. 43, 518.

*Description* :—A shrubby perennial, reaching 6 feet in height, much branched from the base ; branches strictly ascending, terete, woody, spinescent at the tip, slightly silky when young, glabrate when mature. Leaves silky, acicular, lower oblanceolate, shortly acute, to 1 inch long, upper growing gradually smaller and passing into the bracts.

Flowers 1—3, fascicled, forming terminal racemes. Peduncle up to 9 lines long, generally much shorter. Sepals cartilaginous, ovate-acuminate, minutely silky, very small, barely more than 1 line long. Corolla 3 lines long, externally sericeo-hirsute.

Capsule globose, glabrous. Seeds black, opaque.

*Flowers* :—Dec. 1847 (Hooker), Dec. 1889 (Defl.).

*Fruits* :—Dec. 1888 (Schweinf.), Febr. 1851 (Thomson), April 1878 (Perry).

*Locality* :—South-eastern slope of the Koosaf Valley (Defl.) ; valley at the foot of the Shum Shum Range (Schweinf.) ; great valley between Steamer Point and town (Marchesetti) ; without locality (Hook., Thomson, Birdw., Perry).

*Distribution* :—Aden, Highlands of Somaliland.

## 2. *Breweria* R. Br.

Herbs or undershrubs, large and twining, or small and erect. Leaves entire.

Flowers in axillary pedunculate heads or terminal close panicles, or 1—3 together, sessile and axillary. Sepals equal or unequal. Corolla campanulate or infundibuliform ; limb 5-plaited or very shortly and broadly lobed. Stamens included ; filaments filiform, often dilated at the base. Ovary 2-celled ; ovules 4 ; style filiform, equally or unequally bifid, or styles 2 free from the base ; stigmas capitate.

Capsule globose or ovoid, 4-valved, membranous or coriaceous. Seeds normally 4, glabrous or pilose.

*Species* about 25.

*Distribution* :—Tropics of both hemispheres, Australia, N. America.

**1. *Breweria latifolia*** (Hochst. et Steud.) Benth. et Hook. Gen. Pl. II, 87 ; Hook. Fl. Brit. Ind. IV, 224.

*Cressa latifolia* Anders. Journ. Linn. Soc. V, Suppl. p. 25.

*Seddera latifolia* Hochst. et Steud. exsicc. un. itin. n. 884 et Flora 1844, I. Beil. p. 8, tab. 5; Choisy in DC. Prodr. IX, 440; Boiss. Fl. Or. IV, 114.

*Breweria evolvuloides* Vatke in Linnæa (1843) p. 523 (*non* Choisy).

*Breweria argentea* Terrac. in Ann. Istit. Bot. Roma V, 104.

*Description*:—A much-branched, low undershrub with slender, woody branchlets, clothed with dense, short, velvety-white pubescence. Leaves broadly elliptic, rigidulous, shortly stalked, 2—4 lines long, clothed with short adpressed white hairs above and beneath, apex and base generally rounded, the former sometimes inconspicuously mucronate.

Flowers subsessile, solitary in the axils of the leaves or aggregated into short bracteate terminal spikes. Sepals subequal, obovate, coriaceous and rigid with acute herbaceous apex, 2 lines long, back pubescent like the leaves. Corolla not exceeding the calyx, limb two lines in diameter when expanded, tips of midpetaline areas densely hairy. Stamens equal, glabrous; filaments dilated at the base, with short rounded appendages. Ovary obovoid, upper portion hirsute; style divided to the base; stigmas orbicular.

Capsule  $1\frac{1}{2}$  lines in diameter, splitting into 4 rigid valves. Seeds narrowly ovoid, blackish, glabrous, 1 line long.

*Locality*:—Shum Shum Range at a height of 800 feet (Hook.); Wadi Maala (Schweinf.); without locality (Birdw., Hildebrandt).

*Distribution*:—Nubia, Abyssinia, Eritrea, Socotra, S. Arabia, Sind, Baluchistan, Punjab.

*Note*:—Anderson says that Wight's figure of *Seddera evolvuloides* (Icones t. 1369) is merely a glabrous state of our species, which Choisy referred to *Breweria*. *Breweria evolvuloides* Choisy (*Seddera evolvuloides* Wight), occurring at Tuticorin, resembles *B. latifolia* very much, but the leaves are nearly glabrous, the flowers often in twos or threes, on slender bracteolate pedicels  $\frac{1}{2}$ — $\frac{3}{4}$  inch long. *B. latifolia* is a characteristic desert plant.

### 3. *Ipomœa* L.

Herbs (rarely shrubs) twining or prostrate, rarely erect or suberect. Leaves alternate, usually entire.

Flowers usually large, in axillary (rarely paniculate) cymes which are often reduced to a single flower. Sepals 5, equal or unequal, imbricate, often enlarged in fruit. Corolla campanulate or infundibuliform; limb plicate, slightly lobed; bands usually defined by 2 prominent lines. Stamens 5, usually included; filaments filiform or dilated below, often unequal; anthers straight or contorted; pollen echinulate. Ovary 2-

(rarely 3 or 4)-celled ; ovules 4 (rarely 6) ; style filiform ; stigma capitate, entire or 2—3-globose (rarely stigmas 2-linear).

Capsule 4—6-valved, rarely indehiscent. Seeds usually 4 or 6 (rarely solitary), glabrous, bearded or uniformly velvety or woolly.

*Species* about 400.

*Distribution* :—Tropical and warmer regions of the globe.

Leaves not acuminate, usually bilobed or emarginate	.	.	1. <i>I. biloba</i> .
Leaves acuminate	.	.	2. <i>I. calycina</i> .

**1. *Ipomœa biloba*** Forsk. Fl. Aeg.-Arab. p. 44 ; Hook. Fl. Brit. Ind. IV, 212.

*Ipomœa maritima* R. Br. Prodr. 486.

*Ipomœa pescaprae* Roth. Nov. Spec. p. 109.

*Convolvulus pescaprae* L. Sp. Pl. ed. 2, 226.

*Convolvulus maritimus* Lam. Encycl. III, 550.

*Convolvulus bilobatus* Roxb Hort. Beng. 14 et. Fl. Ind. I, 485.

*Batatas maritima* Bojer Hort. Maurit. p. 225.

*Description* :—Root large, long, with a thick brown bark ; stems numerous, very long, prostrate, weak, rarely twining, cylindric, glabrous. Leaves  $1\frac{1}{2}$ — $2\frac{1}{4}$  by 2—3 inches, usually broader than long, usually deeply 2-lobed (the division often extending half-way down, though sometimes the leaf is only emarginate), fleshy, conspicuously parallel-veined, glabrous, cuneate or truncate at the base ; petioles 1— $3\frac{1}{2}$  inches long, glabrous.

Flowers large, usually solitary (sometimes 2—3) ; peduncles erect, 1— $4\frac{1}{2}$  inches long ; bracts beneath the pedicels lanceolate, caducous ; pedicels  $\frac{5}{8}$ — $1\frac{3}{4}$  inches long, stout. Calyx glabrous, the 2 outer sepals smaller than the inner,  $\frac{1}{3}$  by  $\frac{1}{4}$  inch, oblong, obtuse, apiculate, the 3 inner  $\frac{1}{2}$  by  $\frac{3}{8}$  inch, elliptic-oblong, obtuse or emarginate, apiculate. Corolla  $1\frac{1}{2}$ —2 inches long, tubular-infundibuliform, brilliant rose-purple with a deeper colour in the tube, glabrous ; lobes shallow, acute, apiculate. Filaments dilated and hairy at the base. Ovary glabrous.

Capsules  $\frac{1}{2}$ — $\frac{5}{8}$  inch long, ovoid, glabrous. Seeds villous.

*Locality* :—Aden, without precise locality (Birdw.) ; Shaikh O'thman, cultivated (Desf.).

*Distribution* :—Sea-shore of both hemispheres throughout the Tropics.

**2. *Ipomœa calycina*** C. B. Clarke in Hook f. Fl. Brit. Ind. IV, 201 ; Cooke Fl. Bomb. Pres. II, 242.

*Ipomœa calycina* Benth. sec. C. B. Clarke in Hooker f. Fl. Brit. Ind. IV. 201.

*Ipomœa sagittata* Roxb. Ic. ined. (*non* Desf.).

*Ipomœa cardiosepala* Hochst. ex Choisy, in DC. Prodr. IX, 429, 393 ;  
Vatke in Linnæa XLIII, 508.

*Convolvulus calycinus* Roxb. Hort. Beng. 13, et Fl. Ind. I, 471, ed.  
Carey et Wall. II, 51 ; Wall. Cat. 2255.

*Convolvulus Hardwickii* Spreng. Syst. curæ post. 60.

*Aniseia calycina* Choisy. Convolv. Or. 100, et DC. Prodr. IX, 429 ;  
Wight Ill. t. 168 b, fig. 5, et. Ic. t. 833 ; Dalz. and Gibs. Bombay Fl.  
163.

*Description* :—Stem twining, sparingly clothed with long spreading  
hairs. Leaves 2—3 by  $1\frac{1}{4}$ —2 inches, ovate, acutely acuminate, entire,  
sparsely hairy or nearly glabrous, cordate at the base with a wide sinus ;  
petioles  $\frac{1}{2}$ — $1\frac{1}{2}$  inches long, slender, clothed with long spreading hairs.

Flowers 1—3 ; peduncles hairy ; pedicels hairy, about as long as the  
peduncles ; bracts  $\frac{1}{4}$  inch long, ovate, acute. Sepals in flower  $\frac{1}{2}$  inch long,  
unequal, ciliate, the outer in fruit  $\frac{1}{2}$  by  $\frac{1}{4}$  inch, lanceolate-sagittate with  
obtuse auricles, the inner linear-lanceolate. Corolla white, tubular,  
scarcely 1 inch long.

Capsules  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, ovoid, pointed, glabrous. Seeds  $\frac{1}{5}$  inch long  
villous all over, fringed on the margin with soft white hairs which are  
nearly  $\frac{1}{4}$  inch long.

*Flowers and fruits* :—March 1873 (Hildebrandt).

*Locality* :—Aden (*vide* Vatke, Linnæa vol. 43, p. 509).

*Distribution* :—Abyssinia, Aden, India (N. W. Provinces, Oude, W.  
Peninsula).

### XXXIII.—SOLANACEÆ.

Erect, trailing or scandent herbs or shrubs. Leaves alternate, often  
in unequal pairs, rarely clustered, never truly opposite, entire, lobed or  
pinnate ; stipules 0.

Flowers regular in lateral, terminal, axillary or extra-axillary  
cymes, or on solitary or clustered pedicels ; bracts and bracteoles 0.  
Calyx inferior ; limb usually 5-lobed or-toothed, often accrescent in  
fruit. Corolla infundibuliform, campanulate or rotate, often plicate ;  
lobes usually 5. Stamens 5, epipetalous ; anthers ovate or oblong, dihis-  
cing by apical pores or longitudinally. Ovary 2-celled or imperfectly  
1- or 4-celled ; ovules many, on prominent peltate placentas ; style  
linear ; stigma usually capitate.

Fruit a berry or a circumscissile or valved capsule, usually 2-celled,  
many-seeded. Seeds compressed, discoid, or subreniform, with peripheric  
embryo, or seeds scarcely compressed with straight embryo.

*Genera* about 70 ; *species* about 1,250.

*Distribution*.—Warmer regions.

Spinous	.	.	.	.	.	.	.	.	1. <i>Lycium</i> .
Not spinous	.	.	.	.	.	.	.	.	2. <i>Capsicum</i> .

### 1. *Lycium* L.

Spinous shrubs, usually glabrous. Leaves small, alternate or often fascicled, linear, terete or flat.

Pedicels usually solitary (rarely fascicled at the nodes); flowers small. Calyx campanulate, at first 5-merous, then irregularly 3—5-lobed or 2-lipped, in fruit not or scarcely enlarged. Corolla tubular-infundibuliform; lobes 5 (rarely 4), imbricate in bud, spreading in flower. Stamens 5 (rarely 4) on the corolla-tube; anthers exerted or included, dehiscing longitudinally. Ovary 2-celled; ovules few or many; style filiform; stigma subcapitate.

Berry small, globose or oblong. Seeds many, few, or solitary, compressed, scrobiculate; embryo peripheric.

*Species* about 50.

*Distribution*.—Temperate and subtropical regions of the world, especially S. Africa and S. America.

1. *Lycium europæum* L. Syst. Pl. ed. II, p. 28; Anders. Ann. Nat. Hist. ser. II, XX, p. 126 et Journ. Linn. Soc. V, Suppl. p. 26; Hook. Fl. Brit. Ind. IV, 240; Batt. et Trab. Fl. d'Alg. p. 622.

*Lycium indicum* Wight Ic. tab. 1403.

„ *salicifolium* Mill. Dict. n. 3.

„ *mediterraneum* Dun. in DC. Prodr. XIII, 523.

„ *Edgeworthii* Dun. in DC. Prodr. XIII, 523.

„ *saevum* Miers Ill. S. Am. Pl. p. 95.

„ *orientale* Miers Ill. S. Am. Pl. p. 99.

„ *persicum* Miers Ill. S. Am. Pl. p. 100 et Ann. Nat. Hist. (1854) 12.

*Lycium intricatum* Boiss.; Dunal in DC. Prodr. XIII, 525.

„ *arabicum* Schweinf. in Herb. Berol. (ex Krause); Boiss. Fl. Or. IV, 289.

*Arabic name*.—Awsaj.

*Description*.—A spiny, nearly glabrous shrub. Leaves lanceolate or oblanceolate, sometimes pubescent when young,  $\frac{1}{2}$ —1 inch long, alternate or fasciculate. Branches grey.

Flowers white (or light purple),  $\frac{1}{2}$  inch long, solitary, on slender pedicels shorter than the flower. Calyx campanulate, longer than broad, with 5 equal teeth. Corolla-tube cylindrical, gradually widening upwards, somewhat curved; segments of limb short, rounded or ovate.

Filaments glabrous at their base; anthers nearly included in the mouth of the tube.

Berry globose, yellow or red,  $\frac{1}{8}$ -inch in diameter.

*Flowers* :—February 1851 (Thomson), Dec. 1889 (Defl.).

*Fruits* :—January 1880 (Balfour), Dec. 1888 (Schweinf.), Dec. 1889 (Defl.).

*Locality* :—Near the seashore (Hook., Thomson, Anders.); ravine south-west of the Tower of Silence (Defl.); Wadi Maala (Schweinf.); Shum Shum Range above the town from 500—1,300 feet (Busse); without locality (Birdw., Hildebrandt, Balfour, Beever).

*Distribution* :—Southern Europe, N. Africa, Arabia, Socotra, W. India.

## 2. *Capsicum* L.

Annual or perennial herbs, glabrous or nearly so. Leaves entire or repand. Pedicels axillary or 2—3 together.

Calyx campanulate, subentire or minutely 5-toothed, much shorter than the fruit. Corolla rotate; lobes 5, valvate in bud. Stamens 5, attached near the base of the corolla; anthers not longer than the filaments, dehiscing longitudinally. Ovary 2-, rarely 3-celled; style linear; stigma subcapitate.

Berry very variable in form and size, many-seeded. Seeds discoid, smooth or subscabrous; embryo peripheric.

*Species* about 50.

*Distribution* :—Central and S. America, one species in Japan. Many species cultivated in tropical and subtropical regions of the globe.

1. *Capsicum annum* L. Hort. Cliff. (1737) p. 59; Sp. Pl. (1753) p. 188; Fingerh. Monogr. Gen. Caps. (1832) p. 12, t. 2, fig. a; Dunal in DC. Prodr. XIII, I, 412; Hooker Niger Fl. 472; Benth. et Trim. Med. Pl. t. 189; J. Braun in Mitth. Deutsch. Schutzgeb. II (1889) 173; *var. conoides* Irish, in Rep. Missouri Bot. Gard. 1898, 65.

*Capsicum conoides* Mill. Gard. Dict. ed. 8, no. 8; Dunal l. c. 414; Engl. Pfl. Ost.-Afr. C. 351.

*Capsicum conicum var. orientale* Oliv. in Trans. Linn. Soc. XXIX, 118.

Valliacapo-molago Rheede Hort. Malab. IX, 65, t. 35.

*Names* :—Guinea Pepper, Red Pepper, Chilli, Cayenne, Tabasco.

*Description* :—Herbaceous, rarely suffrutescent, 2—5 feet high, branches many, erect, angular, glabrous. Leaves ovate-acuminate to oblong, 2—3 inches long,  $\frac{3}{4}$ —2 inches wide, pubescent on the under surface of the midrib; petiole about  $\frac{1}{2}$  inch long.

Flowers solitary or in pairs; peduncle slightly enlarged upwards. Calyx cup-shaped, usually embracing the base of the fruit, obscurely toothed. Corolla about  $\frac{1}{2}$  inch in diameter, greenish-white; lobes 5—6, ovate, acuminate, often inflexed at the apex. Ovary ovoid attenuate, smooth.

Berry oblong-linear, acute, usually less than  $1\frac{1}{2}$  inches long, on peduncles of about equal length.

*Locality*:—Near the Flag-Staff (Defl.).

*Distribution*:—Widely dispersed in the tropics; probably originally from South America.

*Note*:—Deflers is of opinion that *C. annuum* has been brought to Aden not very long ago. As a matter of fact, no botanist before Deflers has reported this plant as growing in Aden.

#### XXXIV.—SCROPHULARIACEÆ.

Herbs or shrubs, rarely trees. Leaves all or the lower only opposite, rarely all alternate or whorled; stipules 0.

Flowers usually irregular. Calyx inferior, 5-, rarely 4-merous. Corolla hypogynous, more or less 2-lipped or occasionally personate, 4—5-lobed. Stamens usually 4 with or without a rudimentary 5th, less commonly 2 or 5; anthers 1—2-celled, the cells distinct or more or less confluent. Disk annular, cupular, or glandular. Ovary superior, usually 2-celled; ovules many, rarely few in each cell, anatropous or amphitropous; style simple; stigma various.

Fruit usually capsular; placentas on a free central axis or attached to the margins of the valves. Seeds small, of various shapes; hilum lateral or ventral; albumen fleshy, rarely absent; embryo straight or curved.

*Genera* about 200; *species* about 2,200.

*Distribution*:—Throughout the world.

Leaves all alternate . . . . .	3. Anticharis.
Leaves the lower at least if not all opposite	
Corolla spurred or subsaccate at the base in front.	
Corolla spurred . . . . .	1. Linaria.
Corolla subsaccate . . . . .	2. Schweinfurthia.
Corolla not spurred nor subsaccate.	
Stamens 2 . . . . .	5. Campylanthus.
Stamens 4 . . . . .	4. Lindenbergia.

##### 1. *Linaria* Juss.

Herbs, more rarely undershrubs. Lower leaves usually opposite, the upper nearly always alternate, quite entire, dentate or lobed.



Flowers axillary or in terminal racemes or spikes; pedicels ebracteolate. Calyx 5-partite; segments imbricate. Corolla-tube spurred at the base in front; upper lip erect, bilobed; lower lip spreading, 3-lobed, produced at the base into a palate, closing the throat of the corolla, or more rarely depressed, leaving the throat open. Stamens 4, didynamous, ascending, included; filaments filiform; anther-cells distinct, oblong, parallel. Style filiform; stigma small, usually emarginate. Ovules many in each cell.

Capsule ovoid or globose, dehiscing by a 3-valved pore at the apex of each cell, or by 4—10 valve-like teeth, or by circumscissile or valve-like opercula. Seeds ovoid, wingless, angular or rugose, or discoid and surrounded by a membranous wing.

*Species* about 150.

*Distribution*:—Nearly all in the northern extratropical regions of the old world.

Flowers in terminal racemes . . . . .	1. <i>L. macilenta</i> .
Flowers axillary . . . . .	2. <i>L. sagittata</i> .

1. *Linaria macilenta* Dene. in Ann. Sc. Nat. ser. II, II, 252; DC. Prodr. X, 271.

*Description*:—An undershrub, 1 foot high and more, slender, branching; branches elongate, rigid, erect, subspinescent, glabrous. Lower leaves 1 inch long, 2—2½ lines broad, ovate to linear-lanceolate, acute, bidentate-sagittate at the base, attenuate into a thin short petiole, the uppermost leaves awl-shaped, entire. Bracts linear, subulate.

Racemes terminal, loose; pedicels capillary, 2—4 times as long as the calyx. Calyx 5-partite; lobes linear, half as long as the corolla. Corolla (including the spur) 1—1½ lines long, subventricose; upper lip bifid; lobes rotundate; lower lip with rotundate lobes; spur subattenuate, hamose when young, later on as long as the corolla. Style shorter than the corolla, glabrous. Ovary suboblique, subrotund, slightly puberulous at the apex.

Capsule conical, slightly shorter than the calyx, glabrous. Seeds tubercled-echinate.

*Locality*:—Crater and slopes of Shum Shum Range (Shweinf., Desf.); without locality (Birdw., Beevor).

*Distribution*:—Yemen, Sinai, Eritrea.

2. *Linaria sagittata* Hook. f. Bot. Mag. t. 6060; This.-Dyer Fl. trop. Afr. (1906) IV, sect. 2, 291.

*Linaria heterophylla* Steud. Nom. ed. 1, 482; Spreng. Syst. II, 790; Benth. in DC. Prodr. X, 270 (not of Desf.).

*Linaria patula* Baker in Kew Bull. (1895) 222.

*Linaria Webbiana* Visiani L'Orto Bot. di Torino, 142, ex Walp. Rep. III, 195.

*Linaria circinnata* Sweet Brit. Fl. Gard. ser. 2, III, t. 235.

*Linaria Lancerottæ* Delile Sem. Hort. Monsp. (1836) 26 (ex Webb.).

*Antirrhinum heterophyllum* Schousboe Beobacht. Gewächsr. Marrokko 181, t. 3; Willd. Sp. Pl. III, 234.

*Antirrhinum sagittatum* Poir. Dict. Suppl. IV, 19.

*Linaria gracilis* R. Br. in Salt Abyss. Append. 64 et ex Benth. in DC. Prodr. X, 269; Almagia in Ann. Istit. Bot. Roma VIII, 137.

*Linaria gracilis* var. *propinqua* Benth. in DC. Prodr. X, 270.

*Linaria propinqua* R. Br. l. c. 64.

*Description*:—A slender diffusely branched subscandent perennial, glabrous on the branches, leaves and peduncles; stem short, thick; branches terete, woody at the base, sometimes almost leafless. Leaves from a few lines to 2 inches long by  $\frac{1}{3}$  —  $3\frac{1}{2}$  lines broad, narrowly linear to linear-oblong or lanceolate, sagittate or hastate or sometimes cuneate or rounded at the base, entire, acute, rarely obtuse; petiole 1—6 lines long, sometimes tendril-like.

Flowers distant, axillary; peduncles 5—8 lines long. Calyx 2 lines long, glabrous or glandular-pubescent; segments lanceolate, acute or acuminate, more or less scarious on the margins. Corolla (including the spur) 9—10 lines long ( $1\frac{1}{2}$  inches according to J. D. Hooker l. c.), yellow, pilose outside; palate clothed with long citron-yellow hairs; spur about  $\frac{1}{2}$  inch long. Filaments densely pilose.

Capsule shorter than the calyx, globose, glabrous. Seeds reniform, tuberculate.

*Locality*:—Aden (Defl.).

*Distribution*:—Canary Islands, N. Africa, Nubia, Eritrea, Abyssinia, Somaliland, Arabia.

*Note*:—This species has been included on the authority of Deflers. From the above description it is evident that *L. sagittata* is very variable in habit, shape and size of the leaves, and the length of the peduncles. Hemsley and Skan found that many of the specimens cited by them in the 'Flora of tropical Africa' (vol. IV, part 2, p. 291) had been named *L. macilenta* Dene. instead of *L. sagittata* Hook. f. *L. macilenta* is different in habit, has much shorter peduncles, minute flowers, and much smaller capsules.

## 2. *Schweinfurthia* A. Braun.

Annual or perennial diffuse glabrous and glaucous herbs. Leaves usually alternate, quite entire.

Flowers axillary, pedunculate, small. Calyx 5-partite; segments imbricate, the posticous larger than the others. Corolla-tube subsaccate at the base; upper lip 2-lobed, erect, at length reflexed at the margin; lower lip 3-lobed, reflexed-spreading; palate rather prominent, clothing the throat. Stamens 4, didynamous, ascending; filaments glandular-pilose at the base; anther-cells diverging, at length divaricate, confluent at the apex; rudiment of the fifth stamen small. Style filiform; stigma minute. Ovules numerous in each cell.

Capsule subglobose; pericarp fragile; anticus cell many-seeded, dehiscent irregularly; posticous cell much smaller or very small and compressed, 3—4-seeded or empty, indehiscent or at length bursting irregularly. Seeds obconic-truncate, with 6 longitudinal sub-winged ridges.

*Species 4.*

*Distribution* :—Socotra and Comoro Islands, Afghanistan, Western India.

Plant up to 2 feet high; leaves usually narrowly linear; peduncles 5—8 lines long . . . . .	1. <i>S. pedicellata</i> .
Plant 6—9 inches high; leaves elliptic-spathulate to linear- oblong; peduncles 3—5 lines long . . . . .	2. <i>S. pterosperma</i> .

**1. *Schweinfurthia pedicellata* Benth. & Hook. f. Gen. Pl. II (1876) p. 934 (by error *pedicellaris*); Balf. Bot. Socotra p. 201; Cooke Fl. Bomb. Presid. II, 284.**

*Anarrhinum pedicellatum* T. Anders. Journ. Linn. Soc. V, Suppl. p. 26.

*Antirrhinum apterum* Vatke in Oest. Bot. Zeitschr. (1875) p. 96.

*Schweinfurthia aptera* Vatke in herb. reg. berol. ex. Vatke l. c., This.-Dyer Fl. trop. Afr. IV, 2, p. 294.

*Description* :—Suffruticose, erect, branched; stem and branches usually greyish, glabrous or rarely with a few scattered glandular hairs. Leaves  $\frac{1}{2}$ — $1\frac{1}{4}$  by  $\frac{1}{30}$ — $\frac{1}{12}$  inch, sessile, linear, subacute.

Flowers axillary, solitary; pedicels  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, capillary. Calyx  $\frac{1}{8}$  inch long, 5-partite, glabrous; segments  $\frac{1}{10}$ — $\frac{1}{8}$  inch long, ovate, acute, the upper slightly longer and broader than the other 4. Corolla 2-lipped,  $\frac{1}{8}$  inch long, parallel-veined and with 2 lines of hairs in the throat at the lower side; upper lip erect, 2-lobed, the lobes  $\frac{1}{12}$  inch long, oblong, rounded at the apex; lower lip 3-lobed, the lobes oblong-rounded, the middle lobe longer and narrower than the lateral ones. Stamens 4 (with a rudimentary 5th) didynamous, the lower pair the longer; filaments hairy at the base; anthers divaricate. Ovary glabrous; style glabrous.

Capsule  $\frac{1}{8}$ — $\frac{1}{4}$  inch in diameter, globose, fragile, 2-celled, the upper cell with few seeds or empty. Seeds  $\frac{1}{20}$  inch long, obconic, truncate at both ends, strongly ribbed with longitudinal obtuse ribs.

*Flowers and fruits*:—Jan. 1863 (Oliver & Cl.), Febr. 1851 (Hook. & Thomson), March 1878 (Perry), April 1861 (Thomson), Nov. 1888 (Schweinf.), Dec. 1847 (Hook.), Dec. 1889 (Defl.).

*Locality*:—Plain of Maala, slope of Shum Shum Range (Defl.); near the coal depôt of the Messag. Marit. (Schweinf.); great valley between Steamer Point and town (Marchesetti); without locality (Hook., Thomson, Playfair, Oliver & Cl., Perry, Birdw., Lunt).

*Distribution*:—S. Arabia, Socotra, Comoro Islands, Somaliland, Sind.

**2. Schweinfurthia pterosperma** Al. Braun in Sitzungsber. Ges. Naturf. Fr. Vol. 20 (1866) 24, et in Monatsber. Akad. Wiss. Berlin (1866) 872, cum tab.; Terracciano in Ann. Istit. Bot. Roma V, 103; This.-Dyer Fl. trop. Afr. IV, sect. 2, 293.

*Description*:—A much-branched erect annual 6—9 inches high. Leaves up to 1 inch long and 5 lines broad, the uppermost much smaller, elliptic-spathulate to linear-oblong, obtuse, narrowed at the base; petiole from a few lines to  $\frac{3}{4}$  inch long.

Peduncles solitary, 3—5 lines long, filiform. Calyx  $1\frac{1}{4}$ — $1\frac{1}{2}$  lines long; segments ovate-lanceolate, obtuse or subacute. Corolla 3—4 lines long, white, rose-tinted at the throat.

Capsule 3— $3\frac{1}{2}$  lines in diameter; posticous cell 1—3-seeded or quite empty.

*Locality*:—Path leading from Aden to top of Shum Shum Range at about 650 feet (Busse ex Krause), slope of Shum Shum Range (Ellenbeck ex Krause).

*Distribution*:—Nubia, Eritrea, Abyssinia, Somaliland, Arabia.

*Note*:—In my former list of the plants of Aden I combined *Schweinfurthia pedicellata* Renth. & Hook. with *S. pterosperma*; but there seems to be no doubt that these two names represent two distinct species. Vatke wrote in 1875 (Plantæ in itinere Africano ab J. M. Hildebrandt collectæ, in Oesterr. Bot. Zeitschr. XXV. Jahrg. (1875) p. 96): *Antirrhinum apterum* Vatke. [= *Schweinfurthia aptera* Vatke] “ab affini *A. pterospermo* A. Rich. vel *Schweinfurthia p. A. Br.* seminibus eximie differt.”

### 3. Anticharis Endl.

Dwarf erect herbs with glandular pubescence. Leaves entire.

Peduncles axillary, solitary, 1-flowered, often with 2 small bracts. Calyx 5-partite, segments narrow, subvalvate. Corolla-tube dilated

above, limb spreading ; lobes 5, flat, subequal, rounded, the two posticous lobes outside. Stamens 2, anticous ; filaments filiform ; anthers subtransverse, glabrous or sparingly pilose, 1-celled by confluence, horse-shoe or half-moon-shaped before dehiscence, at length flattened out ; staminodes 0. Style filiform, subclavate at the apex ; stigma obtuse, entire or emarginate.

Capsule ovate or oblong, subacuminate, 2-furrowed, loculicidal and septicidal ; valves bent inwards at the margins exposing the placentiferous column. Seeds numerous, small, oblong or obovoid, striate ; embryo straight ; cotyledons ovate.

*Species 9.*

*Distribution* :—8 in Tropical Africa, 2 of which extend to Arabia and Western India and 1 in S. Africa.

Leaves ovate oblong, subobtuse, densely glandular-hairy . . . 1. *A. glandulosa*.

Leaves oblong-lanceolate to lanceolate-linear ; corolla rose-coloured . . . . . 2. *A. arabica*.

Leaves linear, acute. Corolla pale-purple . . . . . 3. *A. linear*

or :

Bracts inserted at or below the middle of the peduncle ; basal lobes of the anthers obtuse ; leaves linear-lanceolate to oblong or elliptic

(a) Leaves often broad, rather obtuse ; capsule  $1\frac{1}{2}$  times as long as the calyx . . . . . 1. *A. glandulosa*.

(b) Leaves often narrow, rather acute ; capsule twice as long as the calyx . . . . . 2. *A. arabica*.

Bracts inserted above the middle of peduncle ; basal lobes of the anthers ; lacuminate leaves linear, acuminate . . . 3. *A. linearis*.

**1. *Anticharis glandulosa*** (Ehrbg. et Hempr.) Aschers. in Monatsber. Kön. Akad. Wissensch. Berlin (1866) p. 880 ; Boiss. Fl. Or. IV, 423 ; Hook. Fl. Brit. Ind. IV, 249 ; This.-Dyer Fl. trop. Afr. IV, 2, p. 277.

“ *Anticharis arabica* Endl.” in Anders. Journ. Linn. Soc. V, Suppl. p. 27 (not the true *Anticharis arabica* Endl.!).

*Distemon glandulosus* Ehrbg. et Hempr. ex Aschers. Monatsber. Kön. Akad. Wissensch. Berlin (1866) p. 881.

*Meisarrhena tomentosa* R. Br. in Salt Abyss. App. 63, *nomen tantum*.

*Description* :—An erect branched leafy herb, scarcely reaching 1 foot high, clothed all over with viscid glandular hairs. Leaves  $\frac{3}{8}$ — $\frac{3}{4}$  inch long, ovate-oblong, subobtuse, densely glandular-hairy, entire, narrowed into a short flattened often obscure petiole.

Pedicels axillary, solitary (very rarely 2 together),  $\frac{1}{2}$  inch long, slender, glandular-hairy ; bracts 2 about the middle of the pedicel, reaching  $\frac{1}{4}$  inch long, linear-spathulate, glandular, hairy. Calyx  $\frac{1}{4}$  inch long, divided to

the base; sepals oblanceolate, acute, glandular-hairy and ciliate. Corolla scarcely  $\frac{1}{2}$  inch long, rose-coloured. Filaments short, filiform, glabrous; anthers versatile, curved, the segments unequal. Ovary ovoid, glabrous, seated on a somewhat cup-shaped disk; style glabrous.

Capsule  $\frac{1}{3}$  inch long, narrowly ovoid, acuminate, pubescent. Seeds about  $\frac{1}{8}$  inch long, oblong, truncate, longitudinally striately ribbed.

*Fruits*:—Aug. 1898 (Birdw.).

*Locality*:—Hill of telegraph office, ravine near Steamer Point, ravine on the northern slope of the Shum Shum Range (Defl.); great valley between Steamer Point and town (Marchesetti); above the coal depôt of the Messag. Marit. (Schweinf.); along the path leading from Aden to the top of the Shum Shum Range between 500 and 1,300 feet (Busse); without locality (Edgew., Hook., Hildebrandt, Wichura, Birdw.).

*Distribution*:—Upper Egypt, Nubia, Abyssinia, Eritrea, northern coast of Somaliland, Socotra, S. Arabia, Sind.

**2. *Anticharis arabica*** Endl. Nov. Sp. Stirp. Dec. 23, et Iconogr. t. 93; Benth. in DC. Prodr. X, 347; Aschers. in Monatsber. Akad. Wiss. Berlin (1866) 881; Boiss. Fl. Or. IV, 422; Almagia in Ann. Istit. Bot. Roma VIII, 137; This.-Dyer Fl. trop Afr. IV, sect. 2, 276.

*Anticharis glandulosa* var. *intermedia* Terracciano in Ann. Istit. Bot. Roma V, 103.

*Anticharis Schimper* Endl. Iconogr. XV (*nomen tantum*).

*Capraria arabica* Steud. & Hochst. ex Benth. in DC. Prodr. X, 347.

*Distemon campanularis* Ehrenb. & Hempr. ex Aschers. l.c. 882.

*Description*:—A slender erect branched shortly glandular-pubescent annual about 1 foot high. Leaves up to 14 lines long,  $1\frac{1}{4}$ — $2\frac{1}{2}$  lines broad, oblong-lanceolate to lanceolate-linear, acute or somewhat acute, attenuated to the base; petiole  $1\frac{1}{2}$ — $2\frac{1}{2}$  lines long.

Peduncles  $2\frac{1}{4}$ —4 lines long; bracts minute, subulate, inserted at about the middle of the peduncle. Calyx 1— $1\frac{1}{2}$  lines long, deeply cleft; segments about  $\frac{1}{2}$  line broad, linear or oblanceolate, acute. Corolla rose-coloured, somewhat viscid,  $3\frac{1}{2}$  lines long; lobes broad, rounded. Anthers free, pilose on the back; basal lobes unequal. Style shorter than the corolla-tube.

Capsule twice as long as the calyx, narrowly ovoid, acuminate or beaked.

*Flowers*:—April 1890 (Defl.), April 1894 (Lunt).

*Fruits*:—April 1894 (Lunt).

*Locality*:—Goldmore Valley, 200 feet (Lunt); without locality (Defl.).

*Distribution* :—Nubia, Eritrea, Somaliland, Socotra, Arabia.

**3. *Anticharis linearis*** Hochst. ex Aschers. in Monatsber. Akad. Wiss. Berl. (1866) 882 ; Vatke in Oest. Bot. Zeitschr. (1875) 9 ; Hiern in Cat. Afr. Pl. Welw. I, 756 ; Hook. Fl. Brit. Ind. IV, 250 ; Boiss. Fl. Or. IV, 423 ; Almagia in Ann. Istit. Bot. Roma VIII, 136 ; This.-Dyer Fl. trop. Afr. IV, sect. 2, 276 ; Cooke Fl. Romb. Pres. II, 281.

*Anticharis arabica* Hochst. ex Benth. in DC. Prodr. X, 347 ; A. Rich. Tent. Fl. Abyss. II, 119 ; Schweinf. Beitr. Fl. Aethiop. 98, not of Endl.

*Doranthra linearis* Benth. in DC. Prodr. X, 347 ; Oliver in Trans. Linn. Soc. XXIX, 120 ; Schweinf. Beitr. Fl. Aethiop. 241.

*Distemon angustifolius* Ehrenb. et Hempr. ex Aschers. l. c. 883.

*Gerardiopsis Fischeri* Engl. Pfl. Ost.-Afr. C. 359, et in Engl. Jahrb. vol. 23, 507.

*Description* :—A much-branched, erect, glandular-pubescent annual, a few inches to more than 1 foot high, turning black in drying. Leaves linear, acute,  $1-1\frac{3}{4}$  by  $\frac{1}{12}-\frac{1}{8}$  inch, sessile, entire, glandular-hairy or nearly glabrous.

Pedicels  $\frac{1}{2}-\frac{3}{4}$  inch long, solitary, filiform, with 2 small linear bracts  $\frac{1}{10}-\frac{1}{8}$  inch long at or near the middle. Calyx  $\frac{1}{5}$  inch long, divided to the base ; sepals linear-lanceolate, acute, glandular hairy. Corolla pale-purple, veined, divided scarcely  $\frac{1}{4}$ -way down ; lobes 5, oblong, obtuse. Anthers versatile, curved, the segments unequal. Style glabrous.

Capsules  $\frac{1}{3}$  inch long, ovoid, acuminate, pubescent, veined. Seeds  $\frac{1}{30}$  inch long, oblong, truncate, longitudinally striately ribbed.

*Locality* :—Neighbourhood of Aden (Hunter).

*Distribution* :—Bornu, Senegambia, Nubia, Kordofan, Eritrea, Abyssinia, German East Africa, Angola, Cape Verd Islands, Egypt, Arabia, Sind, Punjab.

#### 4. *Lindenbergia* Lehm.

Annual or perennial herbs, hard at the base, rarely undershrubs, decumbent or ascending, villous or more rarely glabrescent. Leaves opposite or the upper alternate, dentate.

Flowers subsessile, solitary in the axils of the leaves or in terminal spikes or racemes ; bracts foliaceous ; bracteoles 0. Calyx 5-fid, campanulate. Corolla bilabiate ; tube cylindric ; posticous lip inside, short, broad, emarginate or 2-lobed, erect, spreading ; anticous lip larger, 3.

lobed, spreading. Stamens 4, didynamous, included; filaments filiform; anther-cells distinct, separated, stipitate, all bearing pollen. Style filiform, subclavate at the apex.

Capsule oblong or ovoid, bisulcate, dehiscence loculicidal; valves entire. Seeds many, minute, semi-immersed in the fleshy placentas.

*Species* 14.

*Distribution*:—North-East Africa, Arabia, India, Malaya, China.

**1. *Lindenbergia sinaica* (Dene.) Benth.** Scroph. Ind. p. 22; DC. Prodr. X, 377; Boiss. Fl. Or. IV, 425; Anders. Journ. Linn. Soc. V, Suppl. p. 27.

*Bovea sinaica* Dene. in Ann. Sc. Nat. ser. II, II, 253.

*Description*:—A divaricately much branched densely glandular-pilose undershrub; branches up to about 1 foot long. Lower leaves suborbicular—ovate or ovate, 3—7 lines long and broad, usually shortly petiolate, coarsely crenate-dentate, acute or obtuse, rounded or cuneate at the base; uppermost leaves sessile, smaller, shorter than the calyx.

Flowers opposite in loose secund racemes 6—12 inches long; pedicels  $\frac{1}{2}$ —1 $\frac{1}{2}$  lines long. Calyx 1 $\frac{1}{2}$ —2 lines long, densely glandular-pilose; teeth ovate or ovate-elliptic, unequal,  $\frac{1}{2}$ — $\frac{2}{3}$  lines long, acute. Corolla 7—8 lines long.

Capsule oblong, slightly longer than the calyx, glandular-pilose above.

*Flowers and Fruits*:—January 1872 (Thomson), February 1851 (Thomson), March 1878 (Perry), April 1894 (Lunt), Nov. 1888 (Schweinf.), Dec. 1847 (Hooker).

*Locality*:—In old wells (Hook., Anders.); Goldmore Valley, 100 feet (Lunt); Goldmore Valley, above the coal-depôt of the Messag. Marit. (Schweinf.); on the Shum Shum Range (Busse); without locality (Birdw., Hildebrandt, Perry).

*Distribution*:—Sinai, Egypt, Nubia, Abyssinia, highlands of Somaliland, Central and S. Arabia, Socotra.

### 5. *Campylanthus* Roth.

Shrubs. Leaves alternate, linear, subfleshy, entire.

Flowers in terminal racemes often secund; pedicels with 2 bracts near the base. Calyx deeply 5-fid or 5-partite; segments imbricate. Corolla-tube elongate, slender, incurved; lobes 5, orbicular or ovate, spreading, subequal, imbricate, the lateral exterior in bud. Stamens 2, included; filaments short; anther-cells divaricate, their tips confluent. Ovary 2-celled; ovules many in each cell; style short or long, straight or inflexed; stigma capitate.



Capsule orbicular or broadly ovoid, compressed, septicidal; valves 2-fid or 2-partite. Seeds numerous, orbicular, compressed, notched at the hilum; funicle more or less expanded into a hyaline wing which sometimes surrounds the entire seed.

*Species* 4.

*Distribution* :—Canary and Cape de Verde Islands, Arabia, Sind, Baluchistan.

**1. *Campylanthus juncus*** Edgew. Journ. As. Soc. Beng. XVI, 1217; Anders. Journ. Linn. Soc. V, Suppl. p. 27.

*Description* :—A glabrous, subglaucous undershrub, 1—3 feet high. Branches elongate, virgate, subaphyllous. Leaves linear, acute, entire; lower ones 12½ inches long, 1—2 lines broad, shortly petioled; cauline leaves small, subulate.

Flowers on elongate, virgate, terminal, ½—1 foot long racemes, alternate, pedicellate, secund; pedicels short 1—2 lines long, bibracteate at the base, 1-flowered; bracts small, ciliate. Calyx 5-partite; segments lanceolate, acute. Corolla yellowish-white, much longer than the calyx; tube elongate, incurved, 3 lines long; limb patent, subequal, 3 lines broad; lobes ovate. Stamens 2.

Seeds numerous, orbicular, compressed, marginate.

*Flowers* :—January 1880 (Balfour), February 1851 (Thomson), March 1850 (Madden), March 1898 (Perry), May 1859 (Anderson), Dec. 1847 (Hooker), Dec. 1888 (Schweinf.), Dec. 1889 (Defl.).

*Fruits* :—January 1880 (Balfour), February 1851 (Thomson), March 1850 (Madden), May 1859 (Anderson), June 1872 (Hildebr.), Dec. 1847 (Hooker), Dec. 1888 (Schweinf.), Dec. 1889 (Defl.).

*Locality* :—Plain of Maala, Koosaf Valley (Defl.); Steamer Point (Schweinf.); on gravelly slope of the Shum Shum Range (Ellenbeck); near the tanks (Busse); upper end of the great valley between Steamer Point and town (Marchesetti); abundant, Shum Shum Range (Hooker); without locality (Edgew., Thomson, Madden, Anderson, Balfour, Hildebrandt, Perry, Playfair).

*Distribution* :—Yemen.

### XXXV.—OROBANCHACEÆ.

Annual or perennial parasitic herbs, almost perfectly destitute of chlorophyll, variously coloured, but never green. Stems usually simple, solitary or fascicled, more or less fleshy. Leaves reduced to, often fleshy, scales, few or many.

Flowers in terminal racemes or spikes, supported by bracts and often also by bracteoles, hermaphrodite, zygomorphic. Calyx inferior, gamosepalous, 2—5-toothed or -lobed, rarely truncate, or spathaceous and open in front, or consisting of 2 lateral 1—2-toothed or linear divisions which are either quite free or more or less united at the base in front. Corolla gamopetalous, tubular or funnel-shaped in the upper part, usually curved; limb oblique, 2 lipped or nearly equally 5-lobed; upper lip entire or bilobed, lower lip 3-lobed, lobes imbricate, the upper inside. Stamens 4, didynamous, usually inserted below the middle of the corolla tube and enclosed in it; filaments filiform; anthers dorsifixed, conniving or cohering (by means of hairs) in pairs; cells parallel or slightly diverging, often mucronate, longitudinally dehiscent, both fertile or one empty. Disk hypogynous, obscure or produced anticusly into a nectarial gland. Ovary superior, 1-celled; carpels 2, median, rarely 3; style simple, terminal; stigma orbicular or 2—3-lobed. Placentas 4, separate or contiguous or partly fused in pairs; ovules very numerous, anatropous.

Capsule 1-celled, more or less dehiscent with 2 valves. Seeds very numerous, small; testa often foveolate-reticulate; endosperm fleshy. Embryo globose, of few cells, undifferentiated.

*Genera* 11, *species* about 150.

*Distribution*:—Almost exclusively in the northern hemisphere, particularly in the warm temperate regions.

### 1. *Cistanche Hoffmegg. et Link.*

Parasitic plants, variously coloured, destitute of chlorophyll, glabrous or cobwebby. Stems succulent, often bulbously thickened at the base, simple. Leaves reduced to fleshy scales.

Flowers bracteate and 2-bracteolate, in dense spikes, rather large, white, yellow, violet, or purplish. Calyx persistent, tubular-campanulate, 4- or 5-lobed; lobes obtuse, rounded, subequal or the two posticous narrower. Corolla tubular below, more or less funnel-shaped above, more or less curved or at length abruptly bent; limb spreading, oblique, 5-lobed, lobes broad, equal or nearly so. Stamens 4, didynamous, subexserted, inserted deep down in the corolla-tube; anthers usually densely bearded and coherent by the hairs; cells parallel, often acute or mucronate at the base. Ovary 1-celled, with 4 distinct placentas, many-ovuled; style curved at the apex; stigma large, orbicular.

Capsule 2-valved, dehiscent in the median plane. Seeds very numerous, minute, foveolate-reticulate.

*Species* about 12.

*Distribution*:—Mediterranean region, N. Africa, Western, Tropical and Central Asia.

1. *Cistanche lutea* Hoffmegg. & Link Fl. Port. I, 319, t. 63 ; Reichb. Pl. Crit. VII, t. 700, fig. 939 ; Stapf in Fl. Trop. Afr. vol. IV, sec 2, p. 463.

*Lathræa Phelipæa* Linn. Sp. Pl. ed. 2. II, 844 ; Brot. Fl. Lus. I, 184.

*Orobanche tinctoria* Willd. Sp. Pl. III, 353.

*Phelipæa lutea* Desf. Fl. Atl. II, 60, t. 146 ; Brunner in Flora (1840) II. Beibl. 1 und 4 ; Boiss. Fl. Or. IV, 500.

*Phelipæa tinctoria* Walp. Rep. III, 462 ; Reut. in DC. Prodr. XI, 13.

*Phelipæa senegalensis* Reut. l. c.

*Phelipæa lusitanica* Coss. Not. Crit. Espagne, 43.

*Phelipæa Brunneri* Webb in Hook. Niger Fl. 167.

*Arabic name* :—Hoddar, Hhedar.

*Description* :—Stem swollen at the base, often more than 1 inch in diameter, stout, fleshy, like the whole plant (except the stamens and the inside of the corolla-tube), glabrous,  $\frac{1}{2}$ — $1\frac{1}{2}$  feet high. Scales fleshy, lurid purplish or tinged with yellow, lower crowded, triangular, caudate-acuminate or acute, upper ovate-lanceolate or lanceolate, scattered,  $\frac{1}{2}$ —1 inch long, margins sometimes thin and more or less transparent.

Spike cylindric, rounded at the top, or when young comose by the uppermost bracts, from a few inches to 1 foot long, usually dense, rarely somewhat lax ; bracts ovate-oblong or lanceolate, as long as the calyx or shorter or longer, in substance and colour like the stem-scales ; bracteoles linear, about as long as the calyx. Calyx wide tubular-campulanulate, 6—10 lines long, rarely longer, 5-lobed to  $\frac{1}{3}$  or almost  $\frac{1}{2}$  of its length ; lobes broad, elliptic-oblong, rounded, more or less imbricate, margins membranous. Corolla bright yellow ; tube 1—2 inches long, at first almost straight, then more or less curved, at length often abruptly bent at the middle, cylindric below the middle, wide funnel-shaped above it, more or less villous below the insertion ; lobes much broader than long,  $2\frac{1}{2}$ —3 lines long, rounded. Filaments hairy towards the base ; anthers woolly, cells acute to mucronulate at the base.

*Locality* :—Aden. On roots of *Salvadora persica* (Yerbury).

*Distribution* :—Spain, Cape Verde, Senegambia, Southern Sahara, Nubia, Eritrea, Sennar, French Somaliland (?), throughout North Africa and the Orient.

*Note* :—The Indian *Cistanche tubulosa* Wight "scarcely differs from *C. lutea* Hoffmegg. et Link, the apiculation of the anthers being the distinctive character. This, however, in Tropical African specimens, does not seem to be always a constant one." Cooke, Fl. Bomb. Pres. II, 313.

"Our knowledge of the species of *Cistanche* leaves much to be desired, and an examination of the plants in the field is very desirable, particularly with respect to their variability." Stapf, l. c. p. 464.

### XXXVI.—BIGNONIACEÆ.

Trees, shrubs or woody climbers. Leaves usually opposite, compound ; leaflets opposite, rarely simple ; stipules 0.

Flowers bisexual, generally zygomorphic ; calyx free, gamosepalous, truncate, split or toothed. Corolla tubular or campanulate, lobes 5, imbricate, rarely valvate in bud. Stamens 2 or 4, rarely 5, often a short staminode in place of the 5th stamen. Ovary free, supported by an annular disk, 2-celled, ovules  $\infty$  on two distinct placentas in each cell, attached to the dissepiment ; style filiform, with 2 short stigmatic lobes.

Fruit often elongated, generally dehiscent, the two valves separating from the dissepiment, to which the seeds are attached ; seeds winged, albumen 0.

*Genera* about 105 ; *species* about 1,550.

*Distribution* :—Throughout the tropics of the whole world, largely in tropical America, a few in the warm temperate zones of both hemispheres.

#### 1. *Tecoma* Juss.

Shrubs or small trees, erect or scandent. Leaves usually opposite, simple or compound.

Racemes or panicles terminal. Calyx tubular-campanulate, subequally 5-toothed. Corolla tubular-ventricose, orange or red ; lobes 5, round ; subequal.

Capsule linear or narrow, loculicidally 2-valved, somewhat compressed at right angles to the septum. Seeds thinly discoid ; wing hyaline, broad.

*Species* about 80.

*Distribution* :—Tropics of the whole world, mostly American.

***Tecoma* spec.—**

Cultivated at Shaikh O'thman (Deflers).

### XXXVII. ACANTHACEÆ.

Herbs, shrubs or trees with opposite, usually entire exstipulate leaves.

Flowers usually irregular, in cymes, racemes or spikes or solitary ; bracts large or small or absent ; bracteoles usually 2, sometimes more under the individual flowers, free or connate into an epicalyx. Calyx 5—4-partite. Corolla bilabiate or subequally 5-lobed ; lobes imbricate or

twisted in bud. Stamens 4 or 2, epipetalous; anthers 2—1-celled. Ovary superior, 2-celled; ovules 1 or more in each cell, anatropous; stigma usually bilobed.

Fruit a loculicidal capsule, the valves often elastically recurved, the septum splitting, the seeds born on each half. Seeds usually hard, often clothed with white elastic hairs (best seen when wetted), seated on hard upcurved subacute supports; albumen 0 or scanty.

*Genera* about 140; *species* about 2,000.

*Distribution*:—Tropical and warm temperate regions.

Corolla without an upper lip; lower lip large expanded, 3-lobed . . . . .	1. <i>Blepharis</i> .
Corolla 2-lipped or with 5 subequal lobes:	
Corolla-lobes twisted to the left in bud . . . . .	2. <i>Ruellia</i> .
Corolla-lobes imbricate in bud . . . . .	3. <i>Barleria</i> .

### 1. *Blepharis* Juss.

Harsh prickly, or smooth slender undershrubs generally without stellate or gland-tipped hairs. Leaves by the adjacent pairs being drawn together appearing in whorls of 4, outer pair in each whorl often smaller, sometimes very much smaller, or reduced and almost resembling stipules.

Spikes of flowers strobilate; bract green, ovate or obovate, veined, nearly always spinous; bracteoles 2 or 0, linear, rarely lanceolate, 1-nerved, acute; in many spikes all the bracts except the highest sterile. Calyx sub-4-partite to the base; 2 anticous segments connate nearly to the tip; posticous segment lanceolate, 3-nerved, usually longer than the anticous; 2 interior segments, narrow, long or short. Corolla: posticous lip 0, replaced by a horny rim; anticous lip nearly flat, 3—5-lobed, bluish, white, or fading to yellowish. Stamens 4, sub-similar; anthers 1-celled, narrow-oblong, muticous, fringed with white hairs near the slit; filaments of 2 anticous stamens more flattened with rudiments of missing anther more developed; pollen longish-ellipsoid, with a few very narrow longitudinal smooth chinks not reaching the poles. Ovary 2—1 ovules in each cell, glabrous; style glabrous (rarely with a few thin hairs below), branches 2, lanceolate; at the apex of the ovary on the posticous face are 2 hollows filled with glands.

Capsule ellipsoid, flattened, woody, shining-brown, 2- (rarely 4-) seeded; seeds covered with rope-like bundles of hair, which on applying water unroll into very long 1-celled hairs each furnished with a spiral band within.

*Species* about 50.

*Distribution*.:—Nearly all African, many in South Africa, a few extending through Arabia and the Oriental Region to India.

**1. *Blepharis edulis* (L.) Pers. Syn. II, 180 ; Anders. Journ. Linn. Soc. V, Suppl. p. 28 ; Hook. Fl. Brit. Ind. IV, 479 ; Oliv. Trans. Linn. Soc. XXIX, 128 ; This.-Dyer Fl. trop. Afr. V, 102 ; Boiss. Fl. Or. IV, 520.**

*Ruellia ciliaris* L. Mant. p. 89.

*Acanthus edulis* Forsk. Fl. Aeg.-Arab. p. 114 ; Vahl. Symb. I, 48.

*Ruellia persica* Burm. Fl. Ind. p. 135, t. 42, fig. 1.

*Acanthus imbricatus* Edgew. Journ. As. Soc. Beng. XVI, 1217.

*Acanthus Delilii* Spreng. Syst. II, 819.

*Acanthodium spicatum* Del. Fl. d'Eg. p. 97, tab. 33, fig. 3.

*Arabic names*.:—Sogaf, Soghaf, Chaferab.

*Description*.:—Grey pubescent or nearly glabrate. Stem short, rigid, branched. Leaves in fours at the sterile nodes ; upper pair 2 by  $\frac{1}{2}$  inch, oblong or narrow-elliptic, sessile, spinous-margined ; lower pair smaller but similar.

Inflorescences strobilate, up to 4 inches long, sometimes short ; bracts 1— $1\frac{1}{2}$  inches long, ovate, acuminate, recurved, spinous, puberulous, more or less hairy on the nerves without when young ; bracteoles linear,  $\frac{1}{3}$ — $\frac{1}{2}$  inch long. Posticous calyx-segment  $\frac{1}{2}$ — $\frac{2}{3}$  inch long, broadly ovate, very hairy ; 2 inmost calyx-segments  $\frac{1}{4}$ — $\frac{1}{3}$  inch long. Corolla  $\frac{3}{4}$  inch long or rather more, blue.

Capsule  $\frac{1}{4}$  inch long or rather more, 2-seeded.

*Flowers*.:—January 1863 (Oliver & Cl.), March 1878 (Perry), March 1850 (Madden), April 1861 (Thomson), April 1894 (Lunt), December 1847 (Hooker).

*Fruits*.:—January 1863 (Oliver & Cl.), March 1878 (Perry), April 1861 (Thomson), April 1894 (Lunt), December 1847 (Hooker).

*Locality*.:—Crater of Shum Shum Range, between the Koosaf Valley and the Flag-Staff (Defl.) ; gravelly slope of Shum Shum Range (Ellenbeck) ; along the path leading to the top of the Shum Shum Range at about 650 feet (Busse) ; Wadi Maala (Schweinf.) ; Goldmore Valley (Lunt) ; great valley between Steamer Point and town (Marchesetti) ; in sunny valleys (Edgew., Hook., Madden, Anders.) ; without locality (Birdw., Zenker, Perry, Oliver and Cl.).

*Distribution*.:—Egypt, Sinai, Nubia Abyssinia, Kordofan, Kilimanjaro, Highlands of Somaliland, S., Arabia, S Persia, Baluchistan.

## 2. *Ruellia* Linn.

Herbs or undershrubs. Leaves opposite, subentire.

Flowers sessile or subsessile, solitary or in clusters or racemes; bracts 0; bracteoles large, usually exceeding the calyx. Calyx 5-partite or 5-fid; segments subequal, narrow, acute. Corolla oblique; tube ventricose; lobes subequal, rounded, twisted to the left in bud, spreading in flower. Stamens 4, didynamous; filaments glabrous or sometimes hairy at the base; anthers subequal, 2-celled, the cells oblong, muticous, glabrous; pollen globose, reticulate or honeycombed. Ovary 2-celled; ovules 3—10 in each cell; style linear, hairy; stigma with one oblong-linear branch, the other suppressed or nearly so.

Capsule clavate, cylindric, seed-bearing upwards, solid at the base below. Seeds large, thin, discoid, margined, hygroscopically hairy; retinacula large, strong, hooked.

*Species* about 200.

*Distribution* :—All warm regions.

1. *Ruellia patula* Jacq. Misc. Bot. II, 358; Ic. Pl. Rar. I, 12, t. 119; Lam. Ill. t. 550; T. Anders. in Journ. Linn. Soc. VII, 24 et IX, 460; Oliv. in Trans. Linn. Soc. XXIX, 127; Hook. Fl. Brit. Ind. IV. 412; Engl. Hochgebirgsfl. Trop. Afr. 388; Lindau in Engl. u. Prantl. Pflanzenf. IV, 3B, 310, fig. 124 E, F.

*Ruellia pilosa* T. Anders. in Journ. Linn. Soc. VII, 25 (partly).

*Ruellia Huttonii* T. Anders. in Journ. Linn. Soc. VII, 25 (from descript.).

*Ruellia prostrata* Lam. Encycl. VI, 349 (from descript.); Bedd. Ic. Pl. Ind. Or. t. 282.

*Ruellia matutina* Hochst. et Steud. ex Presl. Bot. Bemerk. 94.

*Ruellia erecta* Roth Nov. Spec. 308.

*Dipteracanthus patulus* Nees in Wall. Pl. As. Rar. III, 82 et in DC. Prodr. XI, 126; Wight Ic. Pl. Ind. Or. t. 1505; Oersted in Vidensk. Meddel. Kjöb. (1854) 180, t. 4, fig. 19—21; Solms-Laub. in Schweinf. Fl. Aethiop. 109, 243.

*Dipteracanthus matutinus* Presl. Bot. Bemerk. 94.

*Petalidium patulum* Dalz. and Gibs. Fl. Bomb. p. 185.

*Arabic name* :—Usara.

*Description* :—A small usually pubescent suberect shrub; stems long, straggling, much-branched, terete or subquadrangular; densely softly pubescent. Leaves  $\frac{1}{2}$ — $1\frac{1}{2}$  by  $\frac{1}{4}$ —1 inch, ovate or elliptic, obtuse, often apiculate, closely pubescent on both sides, base rounded or sometimes shortly and abruptly narrowed; petioles  $\frac{1}{4}$ — $\frac{3}{4}$  inch long.

Flowers axillary, solitary or 2—3 together, nearly sessile; bracteoles nearly  $\frac{1}{2}$  inch long (including a flat stalk  $\frac{1}{16}$ — $\frac{1}{12}$  inch long), foliaceous, elliptic, obtuse, densely pubescent and strongly ciliate. Calyx  $\frac{1}{4}$  inch

long, divided rather more than  $\frac{2}{3}$  the way down, densely pubescent; segments linear-lanceolate, very acute. Corolla purplish-blue,  $1-1\frac{1}{4}$  inches long, pubescent outside; tube in the lower part narrowly cylindric, in the upper part campanulate-infundibuliform; lobes of the limb  $\frac{1}{4}$  inch long broadly elliptic or suborbicular, rounded at the apex. Filaments glabrous. Ovary glabrous; style pubescent.

Capsules  $\frac{1}{2}-\frac{3}{4}$  inch long, clavate, glabrous. Seeds suborbicular, nearly glabrous on the faces, margined with hygroscopic white hairs.

*Flowers*:—January and February 1889 (Schweinf.), March 1884 (Beever).

*Fruits*:—February 1889 (Schweinf.), March 1884 (Beever).

*Locality*:—Shum Shum plateau (Beever); without locality (Anderson, Schweinf., Birdw.).

*Distribution*:—Ava, tropical Africa, Arabia, Sind, Rajputana, Bundelkund, Deccan, Ceylon.

### 3. *Barleria* Linn.

Armed or unarmed small shrubs or undershrubs. Leaves opposite, entire.

Flowers showy, sessile, solitary or in dense or rather lax spikes; bracts and bracteoles large, small or 0. Calyx divided almost or quite to the base; sepals 4 in opposite pairs, the outer pair much the larger. Corolla infundibuliform, tube elongate; lobes 5, subequal, imbricate in bud. Stamens 2, fertile, with oblong 2-celled anthers; usually 2 staminodes occasionally containing a little pollen also present, and often a rudimentary 5th. Disk large, cupular, half embracing the ovary, often with a toothed margin. Ovary 2-celled; ovules 2 in each cell; style long, stigma 2-fid or subentire.

Capsule ovoid or oblong, with 2 or 4 seeds below the middle. Seeds compressed, ovoid, usually clothed with wavy silky closely appressed hairs.

*Species* about 120.

*Distribution*:—Mostly in Africa and Tropical Asia, a few in Tropical America.

**1. *Barleria Hildebrandtii* S. Moore** in Journ. of Botany XV (1877) 69; Kew Bull. (1894) 338.

*Description*:—Stem divaricate, lignose, terete, glabrescent; young branches densely whitish tomentose with scattered strigose, yellowish hairs. Leaves oblong, slightly obtuse, stellately whitish-tomentose, distinctly nerved on the lower surface, the nerves covered with strigose yellowish hairs,  $\frac{1}{2}-\frac{3}{4}$  inch long,  $\frac{1}{4}$  inch broad.



Flowers few, in the uppermost axil (at least in the specimen described by S. Moore); bracts, bracteoles and calyx-segments densely barbato-ciliate; bracteoles oblong,  $\frac{1}{2}$  inch long. Outer calyx-segments subequal, oblong, slightly obtuse or bifid, almost as long as the bracteoles; inner segments subulate, slightly smaller than the outer ones.

Corolla externally puberulous; tube slender,  $\frac{1}{2}$  inch long; limb apparently regular,  $\frac{2}{3}$  inch in diameter; lobes obovate, emarginate. Fertile stamens 2; filaments subulate, puberulous; staminodes 2, very small; style obtuse.

*Locality*:—Aden (ex Kew Bull. (1894) p. 338).

*Distribution*:—Hadramaut: Hills near Dobaibah, at 4,000 feet elevation; Somaliland: 'Ahlgebirge,' 1,500—2,000 met.

### XXXVIII.—VERBENACEÆ.

Herbs, shrubs or trees, with opposite or whorled, simple or digitate exstipulate leaves.

Inflorescence cymose, racemose or spicate. Flowers usually irregular. Calyx inferior, gamosepalous, tubular or cup-shaped usually 5—4-lobed or toothed. Corolla gamopetalous, bilabiate or subequally lobed; lobes usually 5—4. Stamens usually 4, didynamous, epipetalous; anthers 2-celled, dehiscing longitudinally. Ovary superior, sessile, usually 2—4-celled, entire or lobed; ovules 2, sometimes 1, in each cell; style terminal.

Fruit more or less drupaceous, 2—4- or 1-celled; mesocarp juicy, fleshy or dry, seed erect or pendulous, separate in distinct cells; embryo straight; radicle inferior.

*Genera* 73; *species* about 700.

*Distribution*:—Chiefly tropical.

#### 1. *Bouchea* Cham.

Perennial herbs or low undershrubs. Leaves opposite or subopposite, petiolate, ovate or oblong, usually toothed.

Flowers sessile or shortly pedicellate, in terminal spikes or spicate racemes, solitary in the axils of persistent bracts which are shorter than the calyx; bracteoles minute or 0. Calyx narrowly tubular, prominently 5-ribbed, obliquely truncate or shortly 5-toothed, usually becoming more or less dilated below as the fruit ripens, at length splitting longitudinally to the base. Corolla-tube long, slender, cylindric; limb spreading, oblique, with 5 subequal lobes. Perfect stamens 4, didynamous, inserted in the upper part of the corolla-tube, included; filaments very short; anthers ovate with parallel cells. Ovary 2-celled; ovules 1—2

in each cell, erect from the base of the cell; style filiform; stigma sub-2-lobed.

Fruit usually shorter than the calyx and enclosed in it, separating into two elongate-oblong 1-seeded pyrenes.

*Species* about 25.

*Distribution* :—Tropical and S. Africa, Tropical America, India.

Capsule not winged at the apex	.	.	.	.	.	1. <i>B. marrubiifolia</i> .
Capsule winged at the apex	.	.	.	.	.	2. <i>B. pterygocarpa</i> .

**1. *Bouchea marrubiifolia*** (Fenzl.) Schauer in DC. Prodr. XI, 558; Anders. Journ. Linn. Soc. V, Suppl. p. 28; Hook. Fl. Brit. Ind. IV, 564; This.-Dyer Fl. trop. Afr. V, 282.

*Chascanum marrubiifolium* Fenzl. in Kotschy Pl. Nub. n. 32.

*Stachytarpheta cernua* Br. in Salt. Abyss.

*Description* :—A much-branched woody perennial herb; stems and branches pubescent. Leaves  $\frac{1}{2}$ — $1\frac{1}{2}$  by  $\frac{3}{8}$ —1 inch, broadly ovate or suborbicular, coarsely toothed, pubescent on both sides, strongly nerved and rugosely reticulately veined, base truncate or shortly cuneate; petioles  $\frac{1}{2}$ — $\frac{5}{8}$  inch long.

Flowers sessile, in nearly continuous spikes reaching sometimes 8 inches long, closely appressed to the pubescent rhachis; bracts  $\frac{1}{8}$ — $\frac{1}{6}$  inch long, lanceolate, pubescent, with scarious ciliate margins. Calyx tubular,  $\frac{1}{4}$ — $\frac{1}{3}$  inch long, densely pubescent, 5-ribbed, ultimately splitting down one side, truncate at the top, the teeth very minute. Corolla glabrous outside; tube slender,  $\frac{1}{2}$  inch long, slightly enlarged below the limb; limb  $\frac{1}{6}$  inch across; lobes 5, rounded, spreading. Filaments slender, glabrous. Ovary and style glabrous.

Fruit  $\frac{1}{8}$  inch long, enclosed in the calyx, rounded at the apex, consisting of 2 oblong glabrous pyrenes.

*Flowers and fruits* :—January 1863 (Oliver & Cl.), March 1878 (Perry), May 1873 (Hildebr.), Nov. 1888 (Schweinf.), Dec. 1847 (Hooker), Dec. 1889 (Defl.).

*Locality* :—Plain of Maala (Defl.); gravelly slope of Shum Shum Range (Ellenbeck); in the plains (Hook., Anders.); without locality (Birdw., Hildebrandt, Perry, Oliver & Cl.).

*Distribution* :—Egypt, Nubia, Kordofan, Abyssinia, S. Arabia, Sind.

**2. *Bouchea pterygocarpa*** (Fenzl.) Schauer in DC. Prodr. XI, 558; A. Rich. Tent. Fl. Abyss. II, 166; This.-Dyer Fl. trop. Afr. V, 282.

*Chascanum lætum* Fenzl. in Kotschy Pl. Nub. n. 230.

*Description* :—A much-branched perennial herb. Stems clothed with short white pubescence. Leaves ovate, obtuse, deeply toothed, 1— $1\frac{1}{2}$

inches long, cuneate or subtruncate at the base, pubescent on both sides ; petiole  $\frac{1}{2}$  inch long.

End-spikes 6—9 inches long, moderately dense, with all the flowers finally adpressed to the pubescent rhachis ; bracts lanceolate, much shorter than the calyx. Calyx cylindrical, finely pubescent,  $\frac{1}{4}$ — $\frac{1}{2}$  inch long ; teeth very minute. Corolla-tube about  $\frac{1}{2}$  inch long ; limb  $\frac{1}{6}$  inch in diameter.

Capsule linear-oblong, shorter than the calyx, with 2 pyrenes ending in an obtuse wing.

*Locality* :—Near Maala (Schweinf.).

*Distribution* :—Yemen, Eritrea, Abyssinia, Kordofan, Nubia, Usambara.

### XXXIX.—LABIATE.

Herbs, rarely shrubs, often gland-dotted ; branches opposite or verticillate, usually 4-angled. Leaves opposite or whorled ; stipules 0.

Flowers hermaphrodite, irregular, solitary, 2-nate or fascicled and axillary, or in centrifugal spicate cymes which by union in pairs form false whorls ; bracts small ; bracteoles usually minute, opposite. Calyx inferior, gamosepalous, persistent, subregular or irregular, 4—5-fid or distinctly 2-lipped. Corolla gamopetalous ; limb 4-5-lobed or distinctly 2-lipped ; lobes imbricate. Stamens adnate to the corolla-tube, 4, didynamous or only 2 perfect ; anther-cells connate, separate or confluent, dehiscing longitudinally. Disk prominent. Ovary superior, deeply 4-lobed ; style simple from the centre of the ovary between the lobes, erect, filiform ; stigma usually 2-fid, sometimes unequally ; ovules solitary in each lobe of the ovary, erect, anatropous.

Fruit of 4 dry (rarely fleshy) 1-seeded nutlets at the base of the calyx, sometimes 1 or more suppressed. Seed solitary in the nutlets, small, erect ; albumen scanty or 0 ; embryo conform to the seed ; radicle inferior.

*Genera* about 140 ; *species* about 3,000.

*Distribution* :—Cosmopolitan.

Attachment of nutlets basilar.

Corolla-tube short ; lower lip flat ; stigma 2-fid . . . . . 1. Ocimum.

Corolla-tube usually long ; lower lip concave, stigma entire . . . . . 2. Orthosiphon.

Attachment of nutlets slightly oblique to the outer side, the nutlets also dorsally attached to the lobes of the disk . . . . . 3. Lavandula.

#### 1. Ocimum Linn.

Strongly scented herbs, shrubs or undershrubs.

Flowers small, in 6—10-flowered whorls, spicate or racemose pedicels with recurved tips ; bracts small, caducous. Calyx ovoid or

campanulate, deflexed in fruit, 2-lipped; upper lip broad, flat, decurrent, erect in fruit; lower lip usually with 4 mucronate teeth, the 2 middle the largest. Corolla 2-lipped; tube short, not annulate within; upper lip subequally 4-fid; lower lip hardly longer than the upper, declinate, entire, flat, or nearly so. Stamens 4, didynamous, declinate, exserted; filaments free or the lower pair connate below, naked, or the upper toothed or hairy below; anther-cells confluent. Disk entire or 3—4-lobed. Ovary 4-partite; style-lobes subulate or flattened.

Nutlets 4, dry, smooth or subrugose, mucilaginous when moistened, enclosed in the enlarged, membranous, veined, strongly recurved calyx.

*Species* about 60.

*Distribution*:—Throughout the warmer regions of both hemispheres.

**1. *Ocimum suave*** Willd. Enum. Pl. Hort. Bot. Berol. 629; Benth. Lab. 7, et in DC. Prodr. XII, 35; This.-Dyer Fl. Trop. Afr. V, 338; Engl. Hochgebirgsfl. Trop. Afr. 357; Vatke in Linnæa vol. 37, 314.

*Ocimum menthaefolium* Hochst. ex Benth. Lab. (*ex parte*).

*Ocimum anosurum* Fenzl in Flora (1844) 312.

*Ocimum gratissimum* var. *suave* Hook. Fl. Brit. Ind. IV, 609.

*Description*:—A stout branching herb; stems square, with rather sharp angles, shortly and densely pilose to subglabrous; leaves spreading; petiole  $\frac{1}{2}$ — $2\frac{1}{4}$  inches long, pubescent or pilose; blade  $1\frac{1}{2}$ — $3\frac{1}{2}$  inches long,  $\frac{3}{8}$ — $2\frac{1}{2}$  inches broad, flat, ovate or ovate-lanceolate, acute, cuneate at the base, obtusely and somewhat coarsely serrate, pubescent on both sides or occasionally glabrous.

Inflorescence of 3 or more terminal spike-like racemes 3—6 inches long, bearing numerous closely-placed 6-flowered whorls of small flowers; bracts  $1\frac{1}{2}$ —2 lines long, ovate, very acuminate, reflexed, persistent; pedicels  $\frac{1}{2}$ —1 line long, pubescent; flowering-calyx deflexed, thinly pubescent to densely white pilose-pubescent outside, glabrous within; tube 1 line long, campanulate; upper tooth about 1 line long and broad, very broadly ovate with recurved margins; lateral teeth minute, filiform-subulate, with the mouth of the tube above them produced into a lobe or auricle under the upper tooth; lower teeth united into a deltoid body  $\frac{1}{2}$  line long, minutely 2-toothed at the apex; fruiting-calyx enlarged, about  $2\frac{1}{2}$  lines long, with the lobe formed by the lower teeth pressed against the auricles under the upper tooth and closing the mouth of the tube. Corolla scarcely exserted from the calyx, white; tube 1 line long, glabrous; upper lip  $\frac{2}{3}$  line long, subequally 4-lobed; lobes oblong, obtuse, pubescent on the back; lower lip  $\frac{3}{4}$  line long, elliptic, obtuse, very concave, pubescent on the back; stamens exserted, unequal; filaments

free ; upper pair arising near the base of the corolla-tube, 2 lines long, with a stout obtuse hairy reflexed process at the knee ; lower pair inserted just below the base of the lower lip,  $1\frac{2}{3}$  lines long.

Nutlets subglobose,  $\frac{2}{3}$  line in diameter, slightly rugulose, dark brown.

*Locality* :—Aden (Birdw.). Not gathered by any other botanist. Doubtfully indigenous.

*Distribution* :—Transvaal, Natal, Tropical Africa, Tropical Asia.

## 2. *Orthosiphon Benth.*

Herbs, perennial or annual, with erect simple or branching stems ; leaves opposite or rarely whorled, gland-dotted.

Inflorescence terminal, simple or branched, sometimes with 2 or more pairs of flowerless coloured bracts at the apex ; flower-whorls separate, 2—6-flowered. Calyx campanulate or tubular-campanulate, unequally 5-toothed, upper tooth much larger than the others, suborbicular, very broadly ovate or oblong, sometimes decurrent upon the tube. Corolla distinctly 2-lipped ; tube usually exerted much beyond the calyx-teeth, rarely about equalling them, straight or nearly so ; upper lip often partly formed by the truncate mouth of the tube, very shortly 3—4-lobed ; lower lip very concave or boat-shaped. Stamens 4, exerted, directed towards the lower lip ; upper pair with free filaments, not toothed and very rarely bent like a knee near the base, inserted at various heights in the corolla-tube lower pair with their filaments free to the base or variably united, inserted at or just below the base of the lower lip ; anthers 1-celled. Disk usually unequally lobed. Ovary deeply 4-lobed ; style filiform, exerted from the corolla-tube ; stigma slightly thickened and minutely bifid or subentire or divided into 2 short filiform or subulate lobes.

Nutlets oblong, ellipsoid or suborbicular, usually slightly compressed dorsally.

*Species* over 100.

*Distribution* :—S. and Tropical Africa, Madagascar, Socotra, Arabia, India, the Malay Archipelago, Australia.

**1. *Orthosiphon pallidus*** Royle mss.; Benth. in Hook. Bot. Misc. III, 370 ; DC. Prodr. XII, 50 ; Boiss. Fl. Or. IV, 539 ; Hook. Fl. Brit. Ind. IV, 613 ; This.-Dyer Fl. trop. Afr. V, 369.

*Orthosiphon verticillatus* Heyne in Herb. Rottl.

*Orthosiphon inodorus* Koen ; Roxb. Ic. in Herb. Kew.

*Orthosiphon Ehrenbergii* Vatke in Linnæa XXXVII, 316.

*Ocimum reflexum* Ehrenb. ex Schweinf. Beitr. Fl. Aethiop. 126.

*Ocimum nepetæfolium* Hochst. ex Vatke l. c. 316.

*O. reflexus* var. *pallidus* Terrac. in Ann. Istit. Bot. Roma V, 101.

*Description*.:—A small undershrub; branches numerous from a woody rootstock, quadrangular, pubescent. Leaves inodorous,  $\frac{1}{2}$ — $1\frac{1}{2}$  by  $\frac{3}{8}$ — $\frac{7}{8}$  inch, ovate, usually obtuse, crenate or serrate, pubescent on both sides, gland-dotted, base shortly cuneate; petioles  $\frac{1}{8}$ — $\frac{3}{8}$  inch long.

Flowers in rather short racemes, the whorls 6-flowered, distant; bracts  $\frac{1}{2}$  inch long, hairy; pedicels about equalling the flowering calyx, pubescent. Calyx in flower  $\frac{1}{8}$  inch long, twice as long, in fruit, the lower part hairy; upper lip with 3 obtuse lobes, the middle lobe widest; lower lip strongly parallel-nerved, membranous, the 2 central teeth with a long upcurved awn from a narrow lanceolate base, longer than the upper lip, the lateral teeth broadly lanceolate with a short straight awn. Corolla  $\frac{1}{4}$  inch long, white or pale lilac; tube nearly as long as the calyx; upper lip shorter than the suborbicular concave lower lip. Stamens included or scarcely exerted beyond the lower lip. Stigma clavate.

Nutlets  $\frac{1}{16}$  inch in diameter, subglobose, smooth, yellowish-brown.

*Flowers and Fruits*.:—March 1873 (Hildebr.); March 1878 (Perry).

*Locality*.:—Plain of Maala, hill of Steamer Point, Koosaf Valley (Defl.); top of Shum Shum Range at about 1,700 feet (Busse); northern slope of Shum Shum Range (Schweinf.); without locality (Birdw., Playfair); Shum Shum Range, very rare (Perry).

*Distribution*.:—Nubia, Abyssinia, Eritrea, Socotra, S. Arabia, Baluchistan, Sind, North-Western India, from Kashmir and the Punjab to Behar and Travancore.

*Note*.:—"Planta variat virescens et canescens, foliis acutiusculis et obtusis" (Vatke).

### 3. *Lavandula* Linn.

Herbs or shrubs. Leaves incised or entire.

Flowers in 2—10-flowered whorls collected in simple or branched spikes; bracts persistent. Calyx erect, ovoid-tubular, shortly equally 5-toothed, 13—15-nerved. Corolla blue or purple, rarely white, oblique 2-lipped; upper lip 2-fid; lower lip 3-partite with spreading lobes. Stamens 4, didynamous, declinate, included; filaments free; anther-cells confluent. Disk equally 4-lobed, the nutlets dorsally attached to the lobes leaving a large areole on separation. Ovary 4-partite; style shortly 2-fid, the lobes flattened.

Fruit of 4 dry smooth nutlets; basal scar slightly oblique.

*Species* about 30

*Distribution*.:—Chiefly Mediterranean, extending westwards to the Canary Islands and eastwards to India.

**1. *Lavandula setifera*** Anders. Journ. Linn. Soc. V, Suppl. p. 29 ; Defl. Bull. Soc. Bot. France XXXII, 352.

*Description*.—Subherbaceous,  $\frac{1}{2}$ —1 foot high, glabrous. Stems virgate, erect, 6-costate-striate, subtetragonous, subaphyllous, with white pilose reflexed hairs, at last glabrous. Leaves oblong, attenuate into the petiole, entire rotundate or pinnatisect, slightly viscid, hairy.

Spikes 1—1 $\frac{1}{2}$  inches long, ovate or slightly elongate, solitary, simple, terminal, dense, long-peduncled. Bracts alternate, 1-flowered, membranous, dilate at the base, long-setaceous, the lowest as long as the calyx or shorter, the uppermost almost twice as long as the calyx. Calyx oblong-cylindric, 2 lines long, 15-nerved, velutinous ; teeth 5, almost equal, triangular, ciliate and shortly barbed at the apex, very short. Corolla velutinous, violet.

*Flowers*.—Dec. 1888 (Schweinf.), Dec. 1889 (Defl.), March to April (Defl.).

*Fruits*.—January 1880 (Balfour), February 1851 (Thomson), Dec. 1888 (Schweinf.), Dec. 1889 (Defl.).

*Locality*.—Plain of Maala on Jébris at the foot of the Shum Shum Range (Defl.) ; slope of Shum Shum Range (Ellenbeck) ; without locality (Hook., Birdw., Beevor, Balfour).

*Distribution*.—Yemen.

## XL.—NYCTAGINACEE.

Herbs, shrubs or trees. Leaves usually opposite, entire ; stipules 0.

Flowers in terminal or axillary cymes, panicles or corymbs ; bracts often forming a brightly coloured involucre. Flowers hermaphrodite, rarely unisexual, regular, sometimes dimorphous. Perianth monophyllous, small, herbaceous or petaloid, persistent, often accrescent ; tube short or long, sometimes circumscissile above the base ; limb 3—5-toothed or lobed, persistent or deciduous ; the lobes plicate in bud. Stamens 1—30, hypogynous, sometimes unilateral ; filaments small, usually unequal, free or connate into a cup at the base, involute in bud ; anthers 2-celled, dorsifixed, included or exserted, dehiscing longitudinally. Ovary 1-celled ; ovule solitary, erect, campylotropous ; style filiform, involute in bud ; stigma small, simple or multifid.

Fruit membranous, indehiscent, enclosed in the persistent base of the perianth-tube, costate, sulcate, or winged, sometimes glandular. Seed erect ; testa adherent ; albumen soft or floury ; embryo straight with convolute cotyledons or incurved ; radicle inferior.

*Genera* about 22 ; *species* about 220.

*Distribution*.—Chiefly American, a few in Africa, India, the Mascarene and Pacific Islands.

### 1. *Boerhaavia* L.

Erect or diffuse often divaricately branched herbs. Leaves opposite, often in unequal pairs.

Flowers small, paniculate, umbellate or subcapitate, articulated with the pedicel; bracteoles small, often deciduous, rarely whorled and involucrate. Perianth-tube long or short, ovoid below, narrowed above the ovary; limb funnel-shaped with 5-lobed margin, the lobes plicate. Stamens 1 or 2—5, connate below, exserted; filaments capillary, unequal. Ovary oblique, stipitate; ovule erect; stigma peltate.

Fruit enclosed in the ovoid, turbinate or clavate, obtuse or truncate perianth-tube, round, 5-ribbed or 5-angled, viscidly glandular. Seeds with adherent testa; embryo hooked; cotyledons thin, broad, the outer the larger, enclosing a soft scanty albumen.

*Species* about 30.

*Distribution* :—Tropical and subtropical regions.

Flowers both in terminal umbels and lateral whorls	.	1. <i>B. verticillata</i> .
Flowers usually solitary, rarely in pairs	. . .	2. <i>B. elegans</i> .
Flowers all in terminal umbels	. . . . .	3. <i>B. repens</i> .

1. *Boerhaavia verticillata* Poir. Dict. V, 56; DC. Prodr.—XIII, 1, p. 454; Boiss. Fl. Or. IV, 1044; Hook. Fl. Brit. Ind. IV, 710.

*Boerhaavia scandens* Ehrbg. exs. Pl. Sinai; Kotschy It. Nub. n. 144 et It. Syr. n. 126; Anders. Journ. Linn. Soc. V, Suppl. p. 33 [*non* L. Sp. Pl. ed. 3, p. 14 et Chois. in DC. Prodr. XIII, p. 454 !].

*Boerhaavia stellata* Wight Ic. tab. 875.

*Boerhaavia dichotoma* Vahl Enum. Pl. I, 290.

*Boerhaavia repanda* Willd. Sp. Pl. I, 22.

*Boerhaavia grandiflora* Rich. Hohen. in Schimp. Pl. Abyss. n. 2309.

*Arabic name* :—Ormol.

*Description* :—Decumbent or climbing among bushes; branches long, pale, terete, glabrous. Leaves thick,  $1\frac{1}{2}$ — $2\frac{1}{4}$  inches long, nearly as broad or sometimes broader than long, broadly ovate or suborbicular (rarely oblong), obtuse, mucronate, usually glabrous with sinuate margins, base usually cordate; petioles  $\frac{1}{2}$ — $\frac{3}{4}$  inch long, stout.

Flowers in long-pedunculate racemes arranged in few-flowered distant whorls along a slender rhachis; bracteoles small, ovate-oblong, acute; pedicels up to  $\frac{2}{3}$  inch long, slender. Perianth  $\frac{1}{4}$  inch long, white; upper part broadly funnel-shaped, 1 line long, shallowly lobed



accrescent base clavate, 2 lines long, with large globose stalked glands around the apex. Stamens 2, slightly exserted.

Fruit  $\frac{1}{8}$  inch long, clavate, furnished with large glands round the crown.

"This is an exceedingly variable plant; but even in its most aberrant forms the characters of the umbellate inflorescence, exserted stamens and style, and the elongated, clavate, ecostate, glandular fruit, can always be recognized." T. Anderson.

*Flowers*.—From December to March (Schweinf.), January 1880 (Balfour), March 1878 (Perry).

*Fruits*.—March 1878 (Perry).

*Locality*.—Near Maala and the Flagstaff (Defl.); Shum Shum Range (Schweinf., Busse); great valley between Steamer Point and town (Marchesetti); without locality (Hook., Anders., Birdw., Perry, Balfour).

*Distribution*.—Senegambia, Morocco, Egypt, Sinai, Nubia, Abyssinia, Eritrea, Central and S. Arabia, Sind, Western Punjab, Salt Range, Kathiwar, Gujarat, Konkan, Mysore, Travancore, Carnatic.

**2. *Borhaavia elegans*** Chois. in DC Prodr. XIII, 2, p. 453; Boiss. Fl. Or. IV, 1045; Anders. Journ. Linn. Soc. V, Suppl. p. 35; Hook. Fl. Brit. Ind. IV, 710.

*Borhaavia rubicunda* Steud. Nom. ed. 2, I, 213.

*Borhaavia repens* var. *elegans* Aschers. & Schweinf. in Schweinf. Beitr. Fl. Aethiop. 169.

*Borhaavia Marlothii* Heimerl in Engl. Bot. Jahrb. X, 10.

*Description*.—Shrubby below; rootstock woody, much divided; branches erect, 1–2 feet long, glabrous, twiggy, terete. Leaves subsessile, curiously mottled with white when dry,  $1-1\frac{3}{4}$  by  $\frac{1}{5}-\frac{3}{8}$  inch, linear-oblong or oblong-lanceolate, obtuse, often mucronulate, fleshy, rugose, and canescent beneath; petioles  $0-\frac{1}{8}$  inch long.

Flowers solitary, rarely in pairs in very large lax much-branched trichotomous glabrous leafless panicles, sometimes reaching 10 by 8 inches; branches of the panicle slender; bracts at the forks  $\frac{1}{16}$  inch long, lanceolate, acute; bracteoles beneath the flowers (when present) about  $\frac{1}{25}$  inch long, lanceolate, acute, deciduous; pedicels  $\frac{3}{4}-1\frac{1}{2}$  inches long, very slender. Upper portion of the perianth very small, campanulate; accrescent base clavate,  $\frac{1}{8}-\frac{1}{6}$  inch long, pentagonal, viscid or glabrate. Stamens 2.

Fruit  $\frac{1}{8}-\frac{1}{6}$  inch long, clavate, with 5 obtuse strong quiteglabrous ribs, minutely hairy between the ribs.

*Fruits*.—November (Schweinf.).

*Locality*.—Wadi Maala (Schweinf.) ; plain of Maala, Shum Shum Range, Biggari and Koosaf Valley, ravines west and south-west of the Tower of Silence (Defl.) ; great valley between Steamer Point and town (Marchesetti) ; everywhere (Edgew., Hook.) ; without locality (Balfour, Birdw.).

*Distribution*.—Nubia, Uganda, British East Africa, Angola, German S.-W. Africa, German E. Africa, Nyasaland, Zomba, S. Arabia, Baluchistan, Sind, Punjab.

**3. *Boerhaavia repens*** L. Sp. Pl. ed. I, 3 ; Choisy in DC. Prodr. XIII, 453 *incl. var. glabra*) ; Del. Fl. d'Egypte II, 2, t. 3, fig. 1 (*var. minor*) ; Schweinf. Beitr. Fl. Aethiop. 163, et in Bull. Herb. Boiss. IV, App. II, 166 ; Hiern in Cat. Afr. Pl. Welw. I, 882 (partly).

*Boerhaavia vulvarifolia* Poir. Encycl. V, 55.

*Arabic names*.—Chaddir, Chaddar, Rogama, Rugma.

*Description*.—Herbaceous, much-branched. Stems slender, cylindrical, glabrous or nearly so, thickened at the nodes. Leaves in unequal pairs at each node, ovate or lanceolate, acute or obtuse, rounded at the base, slightly undulate, usually glabrous, rarely more than 1 inch long and 9 lines broad.

Peduncles axillary, slender, bearing 4—10-flowered umbels ; bracts small, lanceolate. Perianth about 1 line long ; tube clavate, 5-ribbed, glandular between the ribs ; lobes very short, roundish, pinkish. Stamens 1—3, as long as or slightly longer than the perianth. Stigma peltate.

Fruit  $1\frac{1}{2}$  lines long, enclosed in the strongly 5-ribbed glandular basal part of the perianth.

*Locality*.—Shaikh O'thman (Defl.).

*Distribution*.—Senegal, Nubia, Kordofan, Galabat, Eritrea, Abyssinia, Angola.

## XII.—ILLECEBRACEÆ.

Annual or perennial herbs. Leaves usually opposite ; stipules scarious.

Flowers minute, usually hermaphrodite, cymose, often with scarious bracts. Perianth herbaceous or coriaceous, persistent and often indurated after flowering, 4-5-lobed or 4-5-partite. Petals 0. Stamens as many as the segments of the perianth (rarely fewer or more) and opposite to them, perigynous (rarely hypogynous) ; filaments short ; anthers didymous. Ovary free, 1-celled ; ovule solitary in each cell, erect, or pendulous from a basal funicle ; style 2—3-fid.

Utricle enclosed in the perianth. Seed globose, lenticular or reniform; testa smooth; albumen floury; embryo straight, curved or annular; cotyledons oblong; radicle inferior.

*Genera* 17; *species* about 90.

*Distribution*:—In most warm dry regions.

### 1. Cometes Linn.

Low annular branched herbs. Leaves opposite, sessile or narrowed into a short petiole, mucronate, entire; stipules minute, setaceous.

Flowers 3 together, the central flower only perfect, surrounded by ferruginous feathery many-partite at length elongate and squarrose bracts. Perianth herbaceous, 5-partite; segments erect, linear-oblong, awned at the back below the apex. Stamens 5, perigynous, alternating and united with 5 membranous staminodes forming a cup below; anthers didymous. Ovary ovoid-lanceolate, attenuated into a filiform curved style with 3 minute stigmas; ovule erect.

Utricle enclosed in the perianth, obovoid. Seed obovoid, erect; testa membranous, with a large lateral chalaza; embryo large, on one side of scanty albumen; cotyledons oblong, plano-convex; radicle inferior.

*Species* 2.

*Distribution*:—Tropical Africa, Oriental region, North India.

Staminodes longer than the stamens . . . . . 1 *C. abyssinica*.

Staminodes shorter than the stamens . . . . . 2 *C. surattensis*.

**1. *Cometes abyssinica*** R. Br. in Wall. Pl. As. rar. I, 18, tab. 18; Boiss. Fl. Or. I, 753; This.-Dyer Fl. Trop. Afr. V, 14.

*Saltia abyssinica* R. Br. in Salt Abyss. App. IV, 74.

*Description*:—An erect perennial herb. Stems  $\frac{1}{2}$ —1 foot long, pubescent, many times dichotomously branched. Leaves sessile, spreading, lanceolate, opposite or verticillate, the lower 1—1 $\frac{1}{2}$  inches long.

Clusters of flowers very numerous, terminal on the branchlets; bracts at first comparatively small, finally overlapping the flowers, with many stramineous pungent divisions, so that the heads look like a prickly ball about 1 inch in diameter. Perianth 2 lines long, green; segments oblong tipped with a spreading mucro which becomes as long as the blade. Staminodes lingulate, longer than the fertile stamens.

*Fruits*:—January 1883 (Balfour), March 1878 (Perry).

*Locality*:—Plain of Maala, Biggari and Koosaf Valley (Defl.); Shum Shum Range (Ellenbeck); on the way to the top of the Shum Shum Range at a height of about 670 feet (Busse); the great valley between Steamer Point and the town (Marchesetti); without locality (Perry, Balfour).

*Distribution*:—Central and Southern Arabia, Eritrea, Abyssinia, Nubia, Egypt, Sinai.

2. *Cometes surattensis* Burm. Fl. Ind. 39, t. 15, f. 5; Boiss. Fl. Or. I, 753; Wall. Pl. As. Rar. I, 17, t. 17; Cat. 810; Hook. Fl. Brit. Ind. IV, 712; Cooke Fl. Bomb. Pres. II, 484.

*Cometes apiculata* Dene. in Ann. Sc. Nat. Ser. 2, II, \*244.

*Ceratonychia nidus* Edgew. in Journ. As. Soc. Beng. vol. 16, p. 1215.

*Cometes abyssinica* T. Anders. (*non* R. Br. !) in Journ. Linn. Soc. V, Suppl. p. 32.

*Description*:—A low herb, 4—10 inches high, much-branched from near the base, woody below; branches numerous, erect, terete, pale, glabrous or the young ones slightly pubescent. Leaves  $\frac{1}{2}$ —1 by  $\frac{1}{8}$ — $\frac{1}{2}$  inch, elliptic, acute, mucronate, glabrous, base acute, decurrent into a short often obscure petiole  $\frac{1}{10}$ — $\frac{1}{4}$  inch long.

Flowers 3 together in heads  $\frac{1}{2}$ — $\frac{3}{4}$  inch in diameter (including the bracts), surrounded by numerous pinnatipartite feathery yellowish-red bracts whose ultimate segments are needle-like, which close and interlace over the fruit preventing the escape of the seed and causing it to germinate in the head. Stamens longer than the staminodes.

*Locality*:—Plain of Maala, ravine above the European cemetery of Steamer Point (Schweinf.).

*Distribution*:—S. Arabia, Waziristan, Baluchistan, Sind.

### XLII.—AMARANTACEÆ.

Herbs or undershrubs, erect or with climbing branches. Leaves simple, entire, opposite or alternate; stipules 0.

Flowers usually hermaphrodite, rarely polygamous or dioecious, small, usually in terminal simple or paniculate spikes, cymes or clusters (the outer flowers of a cluster sometimes deformed); bracts hyaline or scarious, never leafy; bracteoles 2, scarious. Perianth usually of 5 free or slightly connate hyaline or scarious persistent sepals, imbricate in bud. Stamens 1—5, opposite the sepals, usually included; filaments usually connate below or united with intervening membranous staminodes in a hypogynous cup; anthers 1- or 2-celled. Ovary 1-celled, ovoid, ellipsoid or globose; ovules 1 or more, amphitropous, erect or suspended from short or long free basal funicles; style sometimes simple or obsolete with capitellate or small stigma, sometimes 2—3-fid with acute stigmas; or styles 2 or 3 papillosely stigmatic on the lower face, erect or recurved.

Fruit a membranous utricle, rarely a circumscissilely or irregularly rupturing capsule, very rarely a berry, inclosed in or supported by the

persistent perianth. Seed inverted or erect, orbicular, ovate or reniform, compressed; testa crustaceous; embryo horseshoe-shaped or annular, surrounding a floury albumen.

*Genera* about 50; *species* about 600.

*Distribution* :—In tropical and warm countries.

Tribe 1. *Amaranteæ*: Anthers 2-locular. Ovary 1-ovuled.

*Euamaranteæ*: Ovule erect, funicle short. Radicle inferior. Leaves alternate . . . . . 1. *Amarantus*.

*Achyrantheæ*: Ovule suspended from the apex of an elongated funicle. Utricle indelhiscent, seed inverse.

Flowers diœcious . . . . . 2. *Salvia*.

With hermaphrodite flowers . . . . . 3. *Aerva*.

Tribe 2. *Celosieæ*: Anthers 2-locular. Ovary 2—∞-ovuled.

Leaves alternate . . . . . 4. *Celosia*.

### 1. *Amarantus* Linn.

Annuals. Leaves alternate, simple, entire, long-petioled, tip often obtuse or emarginate, nearly always glabrous; principal nerves parallel, straight, often conspicuous.

Flowers small, monœcious or polygamous, in axillary clusters or dense terminal and axillary spikes or panicles; bracteoles two. Male flowers: Perianth of 5 (rarely 1—3) membranous equal or subequal ovate-lanceolate segments. Stamens 5 (rarely 1—3); filaments free, subulate or filiform; anthers 2-celled; staminodes 0. Female flowers: Perianth-segments oblong or spatulate, erect in fruit. Ovary ovoid, compressed, 1-celled; ovule solitary, subsessile, erect; styles 1—3 or 0.

Fruit an orbicular or ovoid compressed utricle or a circumscissile membranous or coriaceous capsule. Seed erect, orbicular, compressed; testa crustaceous; embryo annular, enclosing floury albumen; cotyledons linear; radicle inferior.

*Species* about 25.

*Distribution* :—Tropical and subtropical.

An erect herb, leaves 1—3 inches long . . . . . 1. *A. viridis*.

A prostrate herb, leaves  $\frac{1}{4}$ —1 inch long . . . . . 2. *A. polygamus*.

1. *Amarantus viridis* Linn. Sp. Pl. ed. 2, 1405; Grah. Cat. Bomb. Pl. 164; Hook. Fl. Brit. Ind. IV, 720; Trim. Fl. Ceyl. III, 397; Hiern in Cat. Afr. Pl. Welw. I, 888; Durand & DeWild. in Compt. rend. Soc. Bot. Belg. XXXVI, 85; Durand & Schinz Etud. Fl. Congo I, 233 (*excl. Syn. Euxolus viridis* Moquin); This.-Dyer Fl. trop. Afr. VI, sect. 1, 33; Cooke Fl. Bomb. Pres. II, 490.

*Euxolus caudatus* Hook. Niger Fl. 492 *in obs.*; Moq. in DC. Prodr. XIII, pt. 2, 274 (*partim*).

*Chenopodium caudatum* Jacq. Ic. Pl. Rar. t. 344?

*Albersia caudata* Boiss. Fl. Or. IV, 992; Schweinf. in Bull. Herb. Boiss. IV, Append. II, 164.

*Description*:—An erect, much-branched glabrous herb, 1—3 feet high; branches grooved, glabrous, often purplish. Leaves 1—3 by  $\frac{1}{2}$ —2 inches, ovate or deltoid-ovate, obtuse, usually notched at the apex, glabrous, base truncate or cuneate; petioles  $\frac{1}{2}$ —2 inches long.

Flowers shortly pedicellate, pale green, in small axillary clusters and in slender tapering terminal and axillary paniculate spike-like racemes; bracteoles ovate-oblong, acute, with a green keel, shorter than the sepals. Sepals 3, ovate-oblong,  $\frac{1}{10}$ — $\frac{1}{16}$  inch long, membranous, with a strong green keel.

Utricle  $\frac{1}{15}$  inch long, (as long as the perianth), indehiscent, sub-orbicular, compressed, pointed, rugose; styles 2 or 3, short. Seed  $\frac{1}{25}$  inch in diameter, lenticular, smooth, shining, black.

*Distribution*:—Widely distributed in warm countries.

*Uses*:—This species is a pot-herb. The tender tops are eaten.

**2. *Amarantus polygamus* Linn.** Amœnit. Acad. IV (1759) 294; Hook. f. Fl. Brit. Ind. IV, 721; Cooke Fl. Bomb. Pres. II, 491.

*Amarantus polygonoides* Roxb. Fl. Ind. III, 602; Willd. Sp. Pl. IV (1805) 389; Roxb. Fl. Ind. III (1832) 602.

*Amarantus Blitum*, var. *polygonoides* Moq. in DC. Prodr. XIII, 2, 263.

*Amblogyna polygonoides* Dalz. and Gibs. Bomb. Fl. 218.

*Albersia polygama* Boiss. Fl. Orient. IV, 991.

*Euxolus polygamus* Moq. in DC. Prodr. l. c. 272; Thw. Enum. 248 (excl. syn. *Amblogyne*).

*Arabic name*:—Shedach.

*Description*:—A prostrate glabrous annual; stem striate. Leaves small,  $\frac{1}{4}$ —1 inch by  $\frac{1}{4}$ — $\frac{1}{2}$  inch, obovate, obtuse, often notched at the tip, base tapering, on the whole very variable.

Flowers in axillary clusters; bracteoles shorter than the sepals, lanceolate-oblong, awned, membranous, with a strong midnerve. Sepals 3, ovate-oblong, acute membranous, awned and with a strong midnerve. Stamens 3; styles 3.

Fruit urceolate,  $\frac{1}{16}$ — $\frac{1}{12}$  inch long, ovoid, tapering to a sharp point, rugose. Seeds  $\frac{1}{20}$  inch in diameter, lenticular, smooth and shining, black.

*Locality*:—Aden (Boycott).

*Distribution*:—In all tropical countries.

*Note*:—Boycott's specimen in the Herbarium of Kew is named *Amarantus Blitum* Linn. We doubt whether *A. Blitum* is specifically distinct from *A. polygamus* Linn.

## 2. *Saltia* R. Br.

A small glabrous rigid shrub; branches woody, cylindric. Leaves scattered, sessile, narrowly obovate, entire, slightly fleshy, glaucous.

Flowers in lax simple or paniculately branched spikes, diœcious, bracteate. Male flowers 2-bracteolate, not supported by sterile flowers; female flowers with 3—4 irregularly inserted bracteoles, supported on each side by an imperfect flower. Perianth shortly and stoutly stipitate, papery, 5-partite; segments subequal, ovate-oblong, subacute, obscurely 3—5-nerved, sericeous on the back, unchanged when fruiting. Stamens 5, in female flowers minute, anthers empty, in male flowers inserted on a cupular ring, filaments subulate, anthers linear-oblong, 2-locular. Ovary obovoid, at the apex dilate, convex; style filiform; stigma capitellate; ovule 1, suspended from an elongate funicle.

Utricle almost equalling the perianth in length, oblong, membranous, indehiscent. Seed inverse, oblong, turgid; testa membranous, brown, adherent to the floury albumen; arillus 0; embryo peripheric; cotyledons linear-lanceolate, concave, incurved at the apex; radicle slender, erect.

*Species* 1.

*Distribution*:—S. Arabia.

**1. *Saltia papposa*** (Forsk.) Moq. in DC. Prodr. XIII, 2, p. 325; Anders. Journ. Linn. Soc. V, Suppl. p. 32.

*Achyranthes papposa* Forsk. Fl. Aeg.-Arab. p. 48.

*Description*:—A shrub up to 10 feet high, cinereous; stem erect, subterete, few-branched; branches spreading, puberulous, with green bark. Leaves alternate, subsessile, the lowest attenuate into a short petiole, linear, acute, mucronulate, nerveless, glabrous, glaucous.

Spikes short, narrow, on terminal branches. Flowers approximate, 2—4-bracteate; bracts small, carinate, mucronate, slightly villose, one persistent. Sepals 5, ovate, concave, acute, 4-nerved, villose, the inner ones 3-nerved. Stamens 5; filaments subulate, compressed, dilate at the base and forming a cupular ring. Style simple, terete, almost twice as long as the stamens; stigma capitate, globose, entire. Ovary glabrous.

*Flowers*:—March 1878 (Perry), April 1861 (Thomson), June 1872 (Hildebrandt), December 1847 (Hooker), December 1889 (Defl.).

*Fruits*:—March 1878 (Perry), March 1888 (Schweinf.), April 1861 (Thomson), June 1872 (Hildebrandt), November 1888 (Schweinf.), December 1847 (Hooker), December 1889 (Defl.).

*Locality*:—Above the European cemetery of Steamer Point, Goldmore Valley, valley at the foot of the Shum Shum Range, above the coal-dépôt

of the Messag. Marit. in rocky places (Schweinf.); ravine west of the Tower of Silence (Defl.); near the tanks, top of Shum Shum Range (Busse); upper end of the great valley between Steamer Point and town (Marchesetti); in sandy places (Hook., Anders.); without locality (Hildebrandt, Birdw., Lunt); "on a large tree about 8 feet high and spreading" (Perry).

*Distribution*.:—Yemen, Hadramaut near Sibeh.

### 3. *Aerua* Forsk.

Herbs or undershrubs, erect, prostrate or climbing. Leaves alternate, or opposite, or fascicled.

Flowers hermaphrodite or polygamous in simple panicle spikes; bracts and 2 bracteoles small. Perianth 5- (rarely 4-) lobed; sepals equal or the outer broader, all or only the three inner woolly. Stamens 5 (rarely 4); filaments connate, with short or long intervening staminodes, in a short hypogynous cup; anthers 2-celled. Ovary ovoid or subglobose, 1-celled; ovule solitary, pendulous from a long basal funicle; style simple, short or long; stigma capitellate, or stigmas 2.

Fruit a membranous utricle or circumscissile capsule with coriaceous crown. Seed inverse; testa coriaceous; embryo annular, surrounding floury albumen; cotyledons linear; radicle superior.

*Species* 10.

*Distribution*.:—Warmer parts of Africa and Asia.

Flowers unisexual, usually dioecious, sessile in linear or oblong spikes 1—6 inches long forming panicles . . . 1. *A. tomentosa*.

Flowers unisexual, often bisexual in small dense axillary heads 2. *A. lanata*.

1. *Aerua tomentosa* Forsk. Fl. Aegypt.-Arab. CXXII and 170; This.-Dyer Fl. trop. Afr. VI, 37.

*Aerua ægyptiaca* Gmel. Syst. Nat. 1026.

*Aerua incana* Mart. in Nova Acta Nat. Cur. XIII (1826) 291.

*Aerua javanica* Wight Ic. t. 876; Hook. Niger Fl. 492; Hook. Fl. Brit. Ind. IV, 727; Boiss. Fl. Or. IV, 922; A. Rich. Tent. Fl. Abyss. II, 214; Moq. in DC. Prodr. XIII, II, 299 (*partim*); Gareke in Peters Reise Mossamb. Bot. 504; Anders. Journ. Linn. Soc. V, Suppl. p. 31; T. Thomas in Speke Nile Append. 646; Oliv. in Trans. Linn. Soc. XXIX, 141; Engl. Hochgebirgsfl. Trop. Afr. 207; Schinz in Engl. & Prantl Pflanzenfam. III, 1a, 109, in Engl. Pfl. Ost.-Afr. C. 173; Aschers. in Schweinf. Beitr. Fl. Aethiop. 174, (not of Juss.).

*Celosia lanata* L. Sp. Pl. ed 1, p. 298.

*Iresine persica* Burm. Fl. Ind. 212, t. 65, fig. 1.

*Aerua Bovii* Edgew. in Journ. Linn. Soc. VI, 206.



*Achyranthes incana* Roxb. Fl. Ind. I, 671.

*Achyranthes tomentosa* Tuckey Congo Voy. 249.

*Uretia persica* O. Kuntze Rev. Gen. Pl. I, 544 (*partim*).

*Ouret persica* Hiern in Cat. Afr. Pl. Welw. I, 893.

*Arabic name*:—Aerueh, Ra.

*Description*:—Suffruticose, hoary-tomentose, 2—3 feet high; stem terete, branched, as thick as a goose-quill, covered with a thick, easily detachable stellate tomentum. Leaves alternate, variable, 1—2½ by ½—⅝ inch, sessile or nearly so, linear-oblong or oblong-spathulate, obtuse and slightly retuse, or acute, densely tomentose.

Flowers unisexual, usually diceious, dull-white, sessile in linear or oblong spikes 1—6 inches long arranged in naked terminal panicles; bracteoles broadly ovate, acute, white, hyaline. Male flowers: Perianth rather more than ⅙ inch long; sepals elliptic-oblong, subobtuse, woolly at the back. Rudimentary ovary ovoid, acute, usually shortly stipitate with a short style and minutely bifid stigma. Female flowers: Perianth ⅙ inch long, sepals oblong, subacute, apiculate; style about ⅙ inch long; stigmas 2, as long as the style.

Utricle orbicular-ovoid, very thin. Seed ⅙ inch in diam., lenticular, shining, brown-black.

*Flowers and fruits*:—February 1851 (Thomson), April 1861 (Thomson), March 1850 (Madden), March 1878 (Perry), Dec. 1847 (Hooker).

*Locality*:—In valleys, Shum Shum Range (Hook., Thomson, Madden); northern slope of Shum Shum Range (Schweinf.); Shum Shum Range (Ellenbeck); top of Shum Shum Range at about 1,500-1,700 feet (Busse); great valley between Steamer-Point and town (Marchesetti); without locality (Birdw., Hildebrandt, Perry).

*Distribution*:—Cape Verd Islands, E. and W. tropical Africa, North Africa, Yemen, India, Ceylon (not Java).

*Note*:—We followed Baker and Clarke (This.-Dyer Fl. trop. Afr. vol. VI, 37) in adopting Forskal's name '*Aerua tomentosa*' with preference to Jussieu's '*Aerua javanica*' "Forskal", they say, "gives the full name of this species on page CXXII, and an excellent description on page 170. Jusiseu (in Ann. Mus. Par. ii 1803, 131) mentions '*javanicum*' as a species he would transfer to *Aerua*; and, by tracing back, it is found that he meant *Iresine javanica*, Burm. (Fl. Ind. t. 65, fig. 2). It is evident, from Burmann's figures, that *Ae. tomentosa*, Forsk., is *Iresine persica*, Burm., which does not extend so far east as the Malay Peninsula and Java. If, therefore, either of Burmann's names is to be taken, it will be *persica* (as has been done by O. Kuntze and Hiern); but *Ae. tomentosa* Forsk., is not only the older name, but expresses the one characteristic on which the species stands."

**2. *Aerua lanata* Juss.** in Ann. Mus. Pr. II (1803) 131; Moq. in DC. Prodr. XIII, II, 303; A. Rich. Tent. Fl. Abyss. II, 214; Garcke in Peters Reise Mossamb. Bot. 504; Aschers. in Schweinf. Beitr. Fl. Aethiop. 174; T. Thoms. in Speke Nile, Append. 646; Oliv. in Trans. Linn. Soc. XXIX, 141; Wight Ic. t. 723; Hook. Fl. Brit. Ind. IV, 728; Boiss. Fl. Or. IV, 993; Schinz in Engl. & Prantl Pflanzenfam. III, 1a, 109, Engl. Pfl. Ost.-Afr. C. 173; Engl. Hochgebirgsfl. Trop. Afr. 207; This.-Dyer Fl. trop. Afr. VI, 39.

*Achyranthes lanata* Linn. Sp. Pl. ed. 1, 204.

*Achyranthes villosa* Forsk. Fl. Aegypt.-Arab. 48.

*Illecebrum lanatum* Linn. Mant. 344; Schumach. Beskr. Guin. Pl. 144.

*Aerua floribunda* Wight Ic. VI, t. 1776 *bis*, fig. A, et V, t. 1776 (analyses only).

*Ouret lanata* Hiern in Cat. Afr. Pl. Welw. I, 893 (*partim*).

*Arabic name*:—Shagarat-el-athleb.

*Description*:—Erect or prostrate with a long tap-root, branched from near the base; branches many, terete, pubescent or woolly-tomentose, striate. Leaves alternate,  $\frac{3}{4}$ —1 by  $\frac{3}{8}$ — $\frac{5}{8}$  inch on the main stem  $\frac{1}{4}$ — $\frac{3}{8}$  by  $\frac{1}{6}$ — $\frac{1}{4}$  on the branches, elliptic or obovate, or suborbicular, obtuse or acute, entire, pubescent above, more or less white with cottony hairs beneath; petioles  $\frac{1}{8}$ — $\frac{1}{4}$  inch long, often obscure.

Flowers greenish-white, very small, sessile, often bisexual, in small dense subsessile axillary heads or spikes  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, often closely crowded and forming globose clusters; bracteoles  $\frac{1}{20}$  inch long, membranous, broadly ovate, concave, apiculate. Perianth  $\frac{1}{16}$ — $\frac{1}{20}$  inch long; sepals oblong, obtuse, sometimes apiculate, silky-hairy on the back.

Utricle broadly ovoid, acute; stigmas 2. Seed  $\frac{1}{30}$  inch in diameter, smooth and polished, black.

*Locality*:—Aden (Defl.).

*Distribution*:—Throughout Africa, and warm parts of Asia to the Philippines.

#### 4. *Celosia*.

Herbs, usually annual; leaves alternate.

Flowers hermaphrodite, in dense terminal and axillary spikes, sessile or shortly pedicellate, white or coloured; bracts scarious, bracteoles 2, scarious. Perianth of 5 segments slightly connate below, scarious, oblong or lanceolate, acute or obtuse, striate, erect in fruit. Stamens 5; filaments connate below in a membranous hypogynous cup; anthers 2-celled; staminodes 0. Ovary 1-celled, ovoid or subglobose; ovules 2 or more, on long funicles; style 0 or short or long, sometimes elongating in fruit; stigmas simple or 2 or 3, subulate.

Fruit a circumscissilely dehiscent capsule, membranous or sometimes corky or coriaceous. Seeds 2 or more, erect, lenticular; testa crustaceous, black, shining or dull; embryo annular, surrounding floury albumen; cotyledons linear; radicle descending or ascending.

*Species* about 40.

*Distribution* :—Warmer parts of the World.

1. *Celosia argentea* L. Sp. Pl. (1753) p. 205; Forsk. Fl. Aegypt.-Arab. CVII; Moq. in DC. Prodr. XIII, II, 242; A. Rich. Tent. Fl. Abyss. II, 212; Oliv. in Trans. Linn. Soc. XXIX, 140; Aschers. in Schweinf. Beitr. Fl. Aethiop. 178; Engl. Hochgebirgsfl. Trop. Afr. 205; Pfl. Ost-Afr. C. 172; Schinz in Engl. u. Prantl Pflanzenfam. III, 1 A, 93, fig. D, and 99, t. 51, fig. A, B, C; in Engl. Bot. Jahrb. XXI, 180; in Bull. Herb. Boiss. IV, Append. II, 163; Cooke Fl. Bomb. Presid. II, 485.

*Celosia margaritacea* L. Sp. Pl. ed. II, 297.

*Celosia splendens* Schumacher & Thonn. Beskr. Guin. Pl. 140; Moq. in DC. Prodr. XIII, II, 244.

*Description* :—A glabrescent branched annual, 1—4 feet high; stem terete, simple or ascending; branches grooved. Leaves variable, 1—4 by  $\frac{1}{4}$ — $1\frac{1}{4}$  inches, linear-lanceolate, subnarrow, acute, entire, glabrous, base much tapering into a short petiole or leaves sessile.

Flowers at first pinkish, afterwards glistening white, crowded and imbricate, in close cylindric blunt or acuminate terminal spikes 1—3 by  $\frac{3}{4}$ —1 inch, sometimes branching at the apex in a cock's-comb form; bracteoles  $\frac{1}{8}$ — $\frac{1}{5}$  inch long, linear-lanceolate, scarious. Perianth  $\frac{1}{2}$  inch long or more; sepals linear-lanceolate, acute, scarious, with 3 close parallel slender striæ on the back. Stamens short, filaments connate into a cup. Style filiform, elongate after flowering, sometimes exerted in fruit.

Capsules  $\frac{1}{4}$ — $\frac{1}{6}$  inch long, ellipsoid, tapering at the apex into the style, circumscissile about the middle. Seeds 4-8, subreniform, compressed,  $\frac{1}{16}$  inch in diameter, black, polished, shining.

*Flowers and fruits* :—December (Schweinf.).

*Locality* :—At Shaikh O'thman (Schweinf.).

*Distribution* :—Tropical Africa, Arabia, India, Ceylon, South-East Asia, Malaya.

*Note* :—Schweinfurth mentions the variety *Celosia argentea* L. var. *vera* Moq. as occurring at Shaikh O'thman. The distinguishing characters are given with these words: "foliis lineari-lanceolatis subangustis." Considering that *C. argentea* is a very variable plant and assumes very different appearances according to the soil or situation in which it may be found we have dropt the varietal name '*vera*, Moq.'

**XLIII.—CHENOPODIACEÆ.**

Herbs or shrubs. Leaves alternate (rarely opposite); stipules 0.

Flowers small, usually green, hermaphrodite or 1-sexual; bracts 1 or 0; bracteoles 0 or 2. Perianth simple, sepaline; segments 3—5, free or connate, imbricate in bud (in female flowers sometimes 0). Stamens usually 5, opposite the perianth-segments, hypogynous or perigynous; filaments usually free, sometimes with intervening staminodes; anthers 2-celled. Ovary ovoid, globose or depressed, 1-celled; ovule solitary, basal or lateral, campylotropous; style terminal, short or long, stigma petiolate, 2—3-lobed; or styles 2—3; or stigmas 2—5 free or slightly united, sessile.

Fruit usually a utricle enclosed in the often enlarged fleshy perianth (when this is present). Seed erect, inverse or horizontal; testa crustaceous, coriaceous or membranous; albumen fleshy or floury or 0, embryo curved, annular, or spiral.

*Genera* about 80; *species* about 520.

*Distribution*:—Cosmopolitan.

**A. Embryo not spirally twisted.**

- |  |                        |
|--|------------------------|
| 1. Leaves flat, not very small . . . . .                                     | 1. <i>Atriplex</i> .   |
| 2. Leaves $\frac{1}{10}$ inch long, obovate, apparently perfoliate . . . . . | 2. <i>Halopeplis</i> . |

**B. Embryo spirally twisted.**

- |   |                    |
|---|--------------------|
| 1. Bracts small, scale-like. Stamens 5 . . . . .        | 3. <i>Suaeda</i> . |
| 2. Bracts almost always as long as the perianth-leaves. |                    |

Stamens 4—5

**a. Seeds usually horizontal.**

- |  |                      |
|--|----------------------|
| (a) Perianth becoming very hard and the fruit, therefore, resembling a nut . . . . . | 4. <i>Traganum</i> . |
| (b) Perianth remaining unchanged . . . . .   | 5. <i>Salsola</i> .  |

**b. Seeds vertical.**

- |                                   |                       |
|-----------------------------------|-----------------------|
| (a) Branches articulate . . . . . | 6. <i>Anabasis</i> .  |
| (b) Branches continuous . . . . . | 7. <i>Cornulaca</i> . |

**1. *Atriplex* Linn.**

Herbs or undershrubs, mealy, scaly or closely tomentose. Leaves alternate, undivided; blade flat, often toothed or lobed.

Flowers numerous, clustered, in cymes running into terminal spikes and panicles. Branches, and not rarely whole plants carrying flowers all of one sex. Flowers small, unisexual. Perianth of male of 5 lobes united below, without bracteoles. Stamens 5, or 4—3. Female flower without perianth, enclosed between 2 erect ovate or triangular bracteoles. Ovary ovoid, free, with one ovule on a basal stalk, oblique; style cylindric, with usually 2 branches.

Capsule dry, ovoid, flattened, enclosed between the 2 erect (often enlarged thickened or hardened) bracteoles; pericarp thin, membranous. Seed erect; embryo forming one circle round the enclosed albumen.

*Species* about 120.

*Distribution* :—Throughout the world, less numerous in the tropics.

**1. *Atriplex farinosa*** Forsk. Fl. Aeg.-Arab. p. CXXIII; Aschers. & Schweinf. in Schweinf. Beitr. Fl. Aethiop. 289; Boiss. Fl. Or. IV, 917; This.-Dyer Fl. Trop. Afr. VI, 82, not of Dumort. ! nor of Moq. !

*Arabic name* :—Otssfai.

*Description* :—An undershrub, 3 feet high, not mealy (l). Leaves alternate; blade  $1\frac{1}{2}$  by  $\frac{1}{2}$ — $\frac{2}{3}$  inch, in the middle stem-leaves cordate or auricled (sometimes with acute auricles), margin entire or sparingly toothed, under surface with dense minute white tomentum; petioles  $0$ — $\frac{1}{8}$  inch.

Two bracteoles in fruit orbicular,  $\frac{1}{8}$  inch in diameter, flattened, densely tomentose, without tubercles.

*Locality* :—Little Aden: on the seashore east of Jebel Ihsan. (Deffl).

*Distribution* :—Coasts of the Red Sea, Arabia, Nubia, British East Africa, N. Africa.

*Note* :—Defflers reports another species of *Atriplex* as growing in Aden; but does not give any description.

## 2. *Halopeplis Bunge*,

Annuals or shrubs, glabrous or nearly so; branches not jointed.

Leaves  $\frac{1}{10}$  inch long, obovate or orbicular, amplexicaul and appearing perfoliate in the specimens of tropical Africa and Arabia.

Bracts in small spikes, with usually 3 flowers under each. Flowers very small, bisexual. Perianth obconic, with 3 teeth. Stamens 1 or 2. Ovary ovoid, superior; style short, with 2 short linear branches; ovule 1, suspended on a basal funicle.

Seed erect, orbicular, compressed; embryo peripheric round the albumen.

*Species* 3.

*Distribution* :—Mediterranean region, Arabia, Persia, N.-E. Africa, Nubia.

**1. *Halopeplis perfoliata*** (Forsk.) Bunge ex Aschers. et Schweinf. Fl. Aethiop. p. 289 te ex Ung. Sternb. in Cesati, Passer et Gibelli Comp. Fl. Ital. p. 329; Boiss. Fl. Or. IV, 935; This.-Dyer Fl. Trop. Afr. VI, 84.

*Salicornia perfoliata* Forsk. Fl. Aeg.-Arab. p. 3, t.1.

*Halopeplis amplexicaulis* Ces. Pass. & Gib. Compend. Fl. Ital. 271, t. 41, Fig. 2.

*Description*:—A woody branched glabrous shrub, 1—2 feet high; branches with closely placed nodes, not jointed. Leaves  $\frac{1}{10}$  inch long, obovate or orbicular, sessile and minutely decurrent at the base.

Spikes of flowers small, dense; floral bracts similar to the leaves, with usually 3 flowers under each bract, more or less adnate thereto.

*Flowers and Fruits*:—August 1898 (Birdw.).

*Locality*:—Eastern shore of Isthmus (Schweinf.); near Barrier-Gate (Busse); without locality (Birdw.).—Hinterland near Bir Achmed (Defl.).

*Distribution*:—Arabia, Coast of the Red Sea, northwards up to Jeddah and Koser, Nubia, N.-E. Africa.

### 3. *Suaeda* Forsk.

Herbs or shrubs usually growing in saline places. Leaves fleshy, ternate, terete (rarely flattish).

Flowers minute, axillary, usually hermaphrodite, bracteate and 2-bracteolate. Perianth short, globose or urceolate, 5-lobed or 5-partite; segments equal or unequal, simple, gibbous or almost winged. Stamens 5; filaments short; anthers large. Ovary ovoid or orbicular, usually sessile, with a wide base, adnate below to the perianth, rounded or truncate at the apex; ovule solitary, subsessile; style 0; stigmas 2—5, minute, subulate, recurved, papillose throughout.

Fruit a small membranous or spongy utricle included in the perianth. Seed erect, horizontal or oblique; testa coriaceous or crustaceous; albumen 0 or scanty; embryo slender, somewhat spiral.

*Species* about 10.

*Distribution*:—On saline shores and in deserts scattered nearly throughout the world.

Each leaf without a tubercle supporting its base.

Upper leaves nearly 1 inch long; flowers unisexual . . . 1. *S. monoica*.

Upper leaves much less than 1 inch long—

Perianth in fruit fleshy . . . 2. *S. fruticosa*.

Perianth in fruit berry-like . . . 3. *S. baccata*.

Each leaf with a tubercle supporting its base . . . 4. *S. vermiculata*.

1. *Suaeda monoica* Forsk. Fl. Aeg.-Arab. p. 70; DC. Prodr. XII, 2 p. 156; Boiss. Fl. Or. IV, 940; Hook. Fl. Brit. Ind. V, 13.

*Suaeda nudiflora* Thwaites Enum. 246

*Arabic Name*:—Assal.

*Description* :—Usually a large shrub, 5 feet high and more, erect; branches numerous, ascending, marked with prominent leaf-scars, pale, glabrous. Leaves sessile,  $\frac{1}{2}$ —1 by  $\frac{1}{10}$ — $\frac{1}{10}$  inch, linear, obtuse or subacute, sometimes apiculate, bright-green.

Flowers polygamous, in slender lax spikes, the clusters distant, each in the axil of a short leaf; bracteoles minute, ovate, acute, entire. Perianth  $\frac{1}{10}$  inch long; segments oblong, obtuse. Stigmas 2—5, short.

Seed vertical, ovoid, smooth, shining, black.

*Flowers and fruits* :—November (Schweinf.).

*Locality* :—Near Maala, Goldmore Valley, eastern shore of the isthmus (Schweinf.); valley near Steamer-Point, isthmus (Defl.); near the tanks (Busse); without locality (Birdw.).—Very common in the Hinterland between Aden, Shaikh O'thman and Bir Achmed (Defl.).

*Distribution* :—Upper Egypt, Nubia, Libya, Eritrea, Abyssinia, Arabia, Somaliland, Sansibar, South Deccan, Ceylon.

*Note* :—*S. monoica* is a very variable plant. On the sand of the eastern shore of the isthmus close to the highwater-work, this plant which, otherwise, forms high bushes or even small trees is a low decumbent shrub and, growing together with *Suæda fruticosa*, covers the ground as with a thick carpet.

There occurs, besides, another curious form of this species which quite resembles a branch of a Silver Fir spread out on the ground. This appearance is due to the broad-linear, flat and blunt, almost distichously arranged leaves.

Other forms of the same plant and in the same locality are distinguished by flesh-red coloured leaves, whilst the young shoots are generally light green turning dark black-green when old (Schweinf.).

*Uses* :—This plant, which is so common in the vicinity of Aden, is of no slight importance to the inhabitants of Aden. As fire-wood is very scarce on the peninsula, the woody stem and branches of the 'Assal' are used as fuel along with Babul-wood (*Acacia arabica*), which has to be brought from the interior. Every day groups of Arab and Somali women may be seen gathering the shrubs and carrying them in bundles to Shaikh O'thman. From there the wood is brought to Aden by donkeys or camels.

Watt (Commercial Prod. of India, p. 113) says: "There seems to exist a fairly extensive manufacture of sodium carbonate at Aden from the so-called Aden Balsam (? *Suæda nudiflora*). " We have not been able to ascertain whether the 'Aden Balsam' is *Suæda monoica* Forsk. or *Suæda fruticosa* Forsk.

Hunter (under 'Potash or Alkali-burning,' p. 82) says: "Aden balsam, which is however not found in any quantity in the place itself, is

prepared in the Abdali and Fadhly districts. The balsam is thrown into small pits, about 2 feet wide by 1 deep, and wood is added: the mass is then set fire to, and as the sap exudes from the plant, it mingles with the ashes; the mixture is stirred and allowed to cool, when it is dug up and sent to Aden on camels for sale. The price is 8 annas per maund of 28 lbs., and the potash is exported to Bombay for washing purposes."

**2. *Suaeda fruticosa*** Forsk. Fl. Aegypt.-Arab. CIX and 70, Ic. 9; Moq. in Ann. Sc. Nat. ser. 1, Vol. 23, 311, t. 20 et in DC. Prodr. XIII, II, 156; Boiss. Fl. Or. IV, 939; Volk. in Engl. & Prantl Pflanzenfam. III, 1 a, 80; Schweinf. in Bull. Herb. Boiss. IV, Append. II, 157; This.-Dyer Fl. trop. Afr. VI, 91; Cooke Fl. Bomb. Pres. II, 505.

*Chenopodium fruticosum* Linn. Sp. Pl. ed. I, 221.

*Salsola fruticosa* Linn. Sp. Pl. ed. 2, 324; Sowerby Engl. Bot. t. 635.

*Salsola indica* Wall. Cat. 6946, C. (not of Willd.!).

*Salsola laná* Edgew. in Hook. Journ. Bot. II (1840) 286.

*Lerchea obtusifolia* Steud. Nomencl. ed. I, 187, 474; Hiern in Cat. Afr. Pl. Welw. I, 900.

*Lerchea maritima* γ. *fruticosa* O. Kuntze Rev. Gen. Pl. II, 549.

*Arabic name*:—Doluq, Deluq.

*Description*:—Shrubby, usually erect, much-branched; stem pale, glabrous. Leaves fleshy, subsessile,  $\frac{1}{2}$ -terete, variable,  $\frac{1}{5}$ — $\frac{5}{8}$  by  $\frac{1}{16}$ — $\frac{1}{8}$  inch, linear-oblong or ellipsoid or somewhat obovate, obtuse, narrowed at the base; the floral leaves short.

Flowers hermaphrodite, axillary, solitary or 2—3-nate; bracteoles membranous, about  $\frac{1}{20}$  inch long, ovate, acute, entire or with slightly denticulate margins. Perianth in fruit subglobose,  $\frac{1}{10}$  inch long; segments thick, oblong, concave, obtuse, incurved.

Utricle obovoid, thickened at the top; stigmas 3, short, spreading. Seeds  $\frac{1}{5}$  inch long, obliquely ovoid, somewhat beaked, slightly compressed, smooth and shining, black when ripe.

*Locality*:—Eastern shore of the Isthmus (Schweinf.).

*Distribution*:—North Africa and Europe, extending to England and through the Orient to Western India.

*Uses*:—The plant is eaten by camels.

**3. *Suaeda baccata*** Forsk. Descr. Pl. Aegypt.-Arab. p. 69; Schweinf. in Bull. Herb. Boiss. IV; Append. II, p. 157; Volk. in Engl. & Prantl Pflanzenfam. III, 1 a, 80.

*Schanguinia baccata* Moq. in DC. Prodr. XIII, II, 154; Boiss. Fl. Orient. V, 244.



*Suæda baccata* Volk. in This.-Dyer Fl. trop. Afr. VI, 91.

*Description* :—A shrubby diffuse plant. Leaves ovate, obtuse, semiterete, densely arranged, fleshy, shining, punctate, the lower ones sometimes subulate.

Flowers glomerate in the axils, sessile; perianth fleshy, 5-partite. Stamens 5. Pistil 1, tripartite. Stigma subulate. Perianth in fruit more fleshy, coalescent and berry-like.

Fruit a berry, 5-valved, polyspermic.

*Locality* :—Shaikh O'thman (Deff.).

*Distribution* :—Arabia, Eritrea, Egypt.

**4. *Suæda vermiculata* Forsk.** Fl. Aeg.-Arab. p. 70 et. Ic. tab. 18, fig. B; Boiss. Fl. Or. IV, 940; Batt. et Trab. Fl. d'Alg. p. 761.

*Suæda mollis* Del. Fl. d'Eg. p. 57.

*Salsola mollis* Desf. Fl. Atlant. I, 218.

*Salsola globulifolia* Poir. Diet. VII, 298.

*Description* :—A much-branched spreading shrub, sometimes 18 inches in diameter. Branches white-tomentose and in the upper part hairy. Leaves  $\frac{1}{8}$ — $\frac{1}{3}$  inch long, ovate, subglobose, farinose, glandular-pubescent; beneath each leaf is a tubercle decurrent on the stem. Leaves sessile, not rarely pseudopposite on some of the upper branches.

Flowers in dense spikes; bracts spirally placed, suborbicular, whitened on the margins; filaments conspicuously exerted.

*Locality* :—Eastern shore of the Isthmus near Barrier-Gate (Deff.).

*Distribution* :—Arabia, Nubia, N. Africa, Canaries.

*Note* :—It seems strange that Schweinfurth who appears to have closely examined the eastern shore of the Isthmus does not mention this species. Is it not possible that Deffers mistook *S. fruticosa* Forsk. for *S. vermiculata* Forsk., as these two plants resemble each other a good deal?

#### 4. *Traganum* Del.

Shrubs or undershrubs, much-branched; branches not jointed. Leaves alternate.

Flowers perfect, bibracteate, axillary. Perigonium 5-fid, in fruit thickened below, nut-like, furnished in front and behind with a horn-like, conical, obtuse, hard protruberance; the lobes membranous, wingless. Disk small. Staminodes 0. Stamens 5, with broad exerted filaments. Anthers sagittate, acute. Style bifid; stigmas filiform.

Utricle somewhat depressed, included in the woody perigon; pericarp membranous. Seed horizontal; embryo conical-spiral.

*Species* 2.

*Distribution* :—Northern Africa, Arabia.

**1. *Traganum nudatum*** Del. Fl. d'Eg. p. 57; Anders. Journ. Linn. Soc. V, p. 31; Batt. et Trab. Fl. d'Alg. p. 763.

*Description*:—An undershrub; branches divaricate, adpressed to the ground; branchlets slender, intricate, white, glabrous or scabridulous. Leaves alternate, oblong-triangular or terete, short, distant, fleshy, mucronate, dilated at the base, somewhat recurved, keeled, glabrous, glaucous; axils fleecy.

Flowers solitary or 2—3 together. Bracteoles ovate-triangular, a little shorter than the floral leaf. Calyx 5-fid; segments membranous, oblong-lanceolate, obtuse, erect. Stamens 5, exserted; filaments compressed, deflexed; anthers sagittate, ovoid-linear; style filiform, bifid, slightly shorter than the stamens.

Utricle depressed, hidden in the hardened calyx, cylindric, ovoid-truncate,  $1\frac{1}{2}$  lines long.

*Locality*:—On the seashore (Anders., Zenker).

*Distribution*:—Algeria, Egypt, Sinai, Suez, Libya, Nubia, Central and S. Arabia.

### 5. *Salsola* Linn.

Annual or perennial herbs or undershrubs of various habit. Leaves alternate or rarely opposite, sometimes wide sheathing, short, long or scale-like, sometimes mucronate.

Flowers small, solitary in the axils of the upper reduced leaves of the branchlets or spicate. Flowers hermaphrodite, subtended by 2—3 bracteoles. Perianth 5-partite; segments concave, thickened on the back, in fruit furnished on the back with a large horizontal scarious wing, parts below the wing free or connate into an indurated cup. Stamens 5, usually hypogynous; anthers obtuse or with the connective variously produced. Ovary globose or ovoid; style long or short, stigmas 2, spreading, subulate; ovule sessile or pendulous from the tip of a long funicle.

Utricle included in the persistent winged perianth. Seed usually horizontal, orbicular; testa membranous; albumen none; embryo spiral.

*Species* about 40.

*Distribution*:—Chiefly in temperate Asia and North Africa, several in South Africa, 1 in temperate North and South America, 1 in Australia.

Branchlets nearly at right angles to the branches	.	.	.	1. S. Bottæ.
Branchlets not at right angles to the branches	.	.	.	2. S. Forskali.

**1. *Salsola Bottæ*** (Jaub. et Spach) Boiss. Fl. Or. IV, 964; Schweinf. in Bull. Herb. Boiss. IV, Append. II, 161; This.-Dyer Fl. Trop. Afr. VI, 90.

Var. *Fauroti* Franch. in Journ. de Bot. I, 134.

*Halothamnus* *Bottæ* Jaub. et Spach, Ill. Pl. Orient. II, 50, t. 136.

*Caroxylon* *Bottæ* Moq. in DC. Prodr. XIII, II, 178.

*Description* :—A much-branched glabrous shrub, branches patent, 3—7 inches long, virgate, pinnately branched. Leaves few, minute, fleshy, shortly deltoid, adpressed, keeled.

Flowers spaced out on the branches, sessile; bracts 3, ovate, concave, hyaline-margined. Perianth-segments 5, persistent, lanceolate, 2 lines long,  $\frac{3}{4}$  line wide, very dark brown, hyaline-margined. Filaments short; anthers sagittate, about 1 line long, with a short apical appendage. Ovary ovoid; style shortly subulate; stigmas 2, subulate, divergent.

Wings of fruiting perianth inserted below the middle of the segments, 3 outer larger, 2 lines long, nearly 3 lines wide, flabellate, 2 inner slightly shorter and about half the width of the outer.

*Flowers* :—April 1878 (Perry), Dec. 1888 (Schweinf.).

*Fruits* :—Jan. 1880 (Balfour), April 1878 (Perry), Dec. 1888 (Schweinf.).

*Locality* :—Southern slope of Shum Shum Range, above the well of Shaikh Idris, in sandy places and on débris of volcanic rocks (Schweinf.); Koosaf Valley, ravine west of the Tower of Silence, crater of Shum Shum Range (Defl.); without locality (Balfour, Perry).

*Distribution* :—S. Arabia, Somaliland.

*Note* :—Deflers' specimens differ considerably as regards their habit from the type-specimen in the Paris Museum. The branches are much more slender and less spreading. As to the rest they agree perfectly with the detailed description given by Jaubert and Spach.

**2. *Salsola Forskalii*** Schweinf. in Bull. Herb. Boiss. IV, Append. II, 160; This.-Dyer Fl. trop. Afr. VI, 91.

? *Caroxylon imbricatum* Moq. in DC. Prodr. XIII, 2, 177.

? *Salsola imbricata* Forsk. Fl. Aeg.-Arab. p. 57, N. 90, et Ic. t. 8, fig. C.

*Arabic Name* :—Harm (Schweinf.).

*Description* :—A glabrous shrub. Branches erect, much divaricate, white, slender,  $\frac{2}{3}$ —1 foot long,  $\frac{1}{4}$ — $\frac{1}{16}$  inch thick; branchlets hard, very slender, almost horizontally patent, quite straight, white pubescent at the apex. Leaves in small, imbricate, globose glomerules spaced out on the branchlets, minute,  $\frac{1}{8}$  inch and less in diameter, hemispherical, membranous at the edge, puberulous at the apex.

Flowers solitary, axillary, bracteoles triangular-hemispherical, cucullate, thickened in the centre of the back, membranous at the edge, ciliate towards the base; wings inserted at the centre of the back, membranous,

suborbicular. Stamens 5; anthers sagittate, apiculate. Disk indistinctly lobed. Ovary depressed globose; style short; stigmas 2 (rarely 3), oblong-linear.

Fruiting perigone winged,  $\frac{1}{8}$  inch in diameter.

*Fruits* :—In December in Yemen (Schweinf.).

*Locality* :—At the entrance of the Goldmore Valley (Schweinf.); without locality (Birdw.).

*Distribution* :—S. Arabia, Nubian coast, Eritrea.

## 6. *Anabasis* Linn.

Perennial herbs or shrubs, branches jointed. Leaves opposite, fleshy or obsolete.

Flowers small, solitary or clustered, axillary, 2-sexual, female minutely 2-bracteolate. Sepals 5, scarious, fruiting winged or not. Stamens 5, on a short disk, alternating with 5 staminodes.

Utricle included or exerted, subglobose, dorsally compressed, dry or fleshy; style short, stigmas 2, subulate. Seed erect, orbicular, compressed; testa membranous or coriaceous; albumen 0; embryo spiral.

*Species* 17.

*Distribution* :—Mediterranean region, Western and Central Asia, Nubia.

**1. *Anabasis Ehrenbergii*** Schweinf. in Boiss. Fl. Or. IV, 970; Bull. Herb. Boiss. (1896) Append. II, 161.

*Description* :—A glabrous undershrub with a woody caudex. Branches prostrate, up to  $1\frac{3}{4}$  feet long, rooting, very elongate, terete, subarticulate, with a whitish cortex; branchlets abbreviate, 1—6 inches long, erect, almost uniseriate; internodes  $\frac{2}{3}$ — $\frac{4}{5}$  inches long. Leaves opposite, thick, patent, decussate, semi-amplexicaul; the younger ones up to  $\frac{1}{2}$  inch long, oblong, subterete, mucronate or apiculate; the old leaves  $\frac{1}{10}$  inch long, often densely arranged at the base of the branchlets, subglobose, slightly acute or quite obtuse; in the axils short, whitish, woolly hairs.

Flowers axillary, solitary; bracteoles setiform, indistinct. Perigonelobes 5, divided to the base, lanceolate, slightly obtuse at the apex, soon indurate, equal, thickened in the centre of the back, margin broadly membranous, sometimes irregularly denticulate, (wings?). Stamens 5, included; anthers attached at the middle; loculi very acutely apiculate. Ovary globose-ovoid, laterally compressed; stigmas 2, purple, rarely 3, recurved, linear, half as long as the style, always a little longer than the perigone. Ovule pendent from a long funicle.

Seed probably vertical.

*Flowers* :—Dec. 1883 (Schweinf.).

*Locality* :—Eastern shore of the Isthmus, creeping on the sand close to the highwater-mark (Schweinf., Defl.); without locality (Birdw.).

*Distribution* :—S. Arabia, Nubian coast.

*Note* :—Schweinfurth is of opinion that this plant is reproduced chiefly vegetatively. All the flowers which he examined in different localities on the shore of the Red Sea and at different seasons of the year were sterile throughout and in spite of long searching he was not able to secure a single fruit.

## 7. *Cornulaca Delile.*

Small harsh undershrubs; stem (and branches) continuous. Leaves small, alternate, when young ending in a spine.

Flowers axillary, solitary or clustered, buried in wool in all the species except *C. Ehrenbergii*, polygamous, mostly imperfect. Perianth-segments 5, united into a hard cup at the base; segments lanceolate, dilated upwards, membranous, or 1 or 2 of them spinous. Stamens 5; staminodes short, quadrate. Ovary ovoid, free or immersed in a disc; style short, with 2 branches; ovule 1, nearly sessile.

Utricle enclosed within the hardened base of the perianth; embryo spiral, without albumen; seed (where known) horizontal

*Species* 4 or 5.

*Distribution* :—From North Africa to Kabul.

1. *Cornulaca monacantha* Del. Fl. Egyp. 206, t. 22; Moq. in DC. Prodr. XIII, 2, 218; Schweinf. Beitr. Fl. Aethiop. 186; Zarb in Cat. Spéc. Bot. Pfund 34; Boiss. Fl. Or. IV, 984; Batt. et Trab. Fl. Alg. I, 767; Volk. in Engl. und Prantl. Pflanzenfam. III, 1a, 89, fig. 44, A-D, Durand et Barratte Fl. Libye. Prodr. (1910) 208.

*Traganium nudatum* Sieb. ex Moq. in DC. Prodr. XIII, 2, 172.

*Description* .—A much-branched rigid low undershrub. Leaves  $\frac{1}{6}$ — $\frac{1}{4}$  inch long, lanceolate, curved, ending in a spine, the base ovate, many distant; in age the spine often disappears, and the base of the leaf on the old branches becomes a cushion.

Flowers clustered, buried in wool. Perianth in flower  $\frac{1}{8}$  inch long; the spatulate lobes elongate in fruit, and one at least usually becomes spinescent.

*Locality* :—Great valley between Steamer-Point and town (Marchesetti, from manuscript note in his 'Ausflug nach Aden'). We have not seen this plant.

*Distribution* :—Tunis, Sahara desert in the Teda country, Egypt, Nubia, Arabia, Persia, Afghanistan.

*Uses* :—According to Ritchie this plant is a good purgative for man and beast.

#### XLIV.—ARISTOLOCHIACEÆ.

Erect or climbing herbs or shrubs. Leaves alternate, entire or lobed, exstipulate.

Flowers axillary, solitary or cymose, foetid, hermaphrodite. Perianth superior, often produced into a tube above the ovary, equally or unequally 3-lobed, or unilateral and undivided. Stamens 6 to many, epigynous, gynandrous; anthers 2-celled, dehiscing longitudinally. Ovary inferior, rarely free at the apex, perfectly or imperfectly 3—6-celled; ovules numerous, anatropous, horizontal or pendulous; style connate into a column (gynostemium), free above.

Capsule indehiscent or septicidal. Seeds often immersed in the inner layer of the endocarp, triquetrous or flattened by pressure, albuminous; raphe sometimes thickened or winged; testa hard; embryo small.

*Genera* 5; *species* about 200.

*Distribution* :—Cosmopolitan, chiefly tropical.

##### 1. *Aristolochia* Linn.

Shrubs or perennial herbs, prostrate or twining. Leaves alternate, entire or lobed, often with a stipule-like leaf of an undeveloped bud in the axil.

Perianth coloured; tube inflated below, then contracted, hairy within; limb oblique, usually 2-lipped. Stamens 6 (rarely 5 or more than 6), adnate 1-seriately above the ovary, the filaments or connectives not distinguishable from the style; anthers adnate to the column; dehiscence extrorse. Ovary inferior, more or less perfectly 6-celled (rarely 5- or 4-celled); placentas parietal or intruded or conniving and connate in the axis; ovules many, 2-seriate; style or column short, thick, divided above into 3 or 6 (rarely more) obtuse or linear short lobes.

Capsule lantern-like, septicidally 6-(rarely 5-) valved or splitting through the placentas. Seeds usually many, horizontal, often covered by the remains of the placentas; albumen fleshy; embryo minute.

*Species* about 190.

*Distribution* :—Cosmopolitan, but more numerous in warm climates.

**1. *Aristolochia bracteata* Retz.** Obs. V, 29; Duch. in DC. Prodr. XV, I, 478; Hook. Fl. Brit. Ind. V, 75; Solereder in Engl. Bot. Jahrb. X, 441; This.-Dyer Fl. trop. Afr. VI, 136.

*Aristolochia bracteolata* Lam. Encycl. I, 258; Klotzsch in Monatsber. Berl. Akad. (1859) 598.

*Aristolochia mauritiana* Pers. Enchir. II, 527.

*Aristolochia Kotschyi* Hochst. ex A. Rich. Tent. Fl. Abyss. II, 237.

*Aristolochia maurorum* Klotzsch in Monatsber. Berl. Akad. (1859)

598.

*Aristolochia abyssinica* Klotzsch *ibid.*

*Aristolochia crenata* Ehrbg. ms. in Herb. Berol.

*Aristolochia sempervirens* Forsk. Fl. Aegypt.-Arab. p. 156.

*Arabic Name* :—Läya, Lā (Schweinfurth) ; *Erig agrab* (Kew Herb.).

*Description* :—A slender perennial ; stems 12—18 inches long, weak, prostrate, branched, striate, glabrous. Leaves cordate-ovate, entire,  $1\frac{1}{2}$ —2 (or even 3) inches long, with a broad basal sinus, glaucous beneath, finely reticulately veined, glabrous ; petioles  $\frac{1}{2}$ — $1\frac{1}{4}$  inch long.

Flowers solitary, axillary ; pedicels 2 lines long, with a large sessile orbicular or subreniform bract at the base. Perianth dark brown,  $1-1\frac{3}{4}$  inches long ; base subglobose ; tube cylindric with a trumpet-shaped mouth ; lip linear, dark purple, with revolute margins, finely reticulately veined, as long as the tube. Stamens and styles 6.

Capsule shortly pyriform or subglobose, about 9 lines long and .7 lines wide, 12-ribbed, glabrous. Seeds obcordate, flat, 3 lines long, 3 lines broad at the apex.

Every part of the plant is nauseously bitter.

*Flowers and fruits* :—March, on the south-coast of Arabia (Schweinf.).

*Locality* :—Aden (Birdw.).

*Distribution* :—Northern Nigeria, Eastern Chari, Nubia, Abyssinia, Kordofan, Eritrea, Jur, Uganda, British East Africa, Sennaar, Abyssinia, Arabia, Sind, Bundelkhund, Deccan, Ceylon, Sandwich Islands.

*Uses* :—A friction with its root is used by natives against scorpion bites. (A. F. Broun in folio Herb. Kew.).

#### XLV.—LORANTHACEÆ.

Chlorophyll-containing shrubs or more rarely herbs, parasitic on other plants, very rarely trees. Leaves opposite, ternate or alternate, simple, entire, exstipulate, sometimes reduced to mere scales or teeth.

Inflorescence racemose or cymose. Flowers often large and brightly coloured (*Loranthus*), or small, greenish and inconspicuous (*Viscum*), regular or zygomorphic, hermaphrodite or unisexual, 3—6-merous. Calyx superior, gamo-sepalous, lobed or truncate, sometimes obsolete. Corolla superior, polypetalous or gamopetalous, petaloid or sepaloid, valvate in bud. Stamens as many as and opposite the petals or corolla-lobes, and inserted on them ; anthers usually 2-celled, sometimes divided into numerous small cells, which may be arranged irregularly (*Viscum*) or in 2 or 4 vertical rows (*Loranthus*). Disc superior, annular or absent.

Ovary inferior, usually without a distinct placenta and ovule ; style simple or absent ; stigma not or hardly lobed.

Fruit usually baccate, crowned by the persistent calyx when the latter is present ; pericarp sticky. Seed solitary, albuminous or exalbuminous, without a distinct testa ; embryo fairly large, terete or angled, with distinct hypocotyl and 2 (more rarely 3—6) cotyledons.

*Genera* 24 ; *species* about 1,000.

*Distribution* :—Chiefly tropical and subtropical.

### 1. *Loranthus* Linn.

Green leafy shrubs, parasitic on Dicotyledons, seldom on Coniferæ or Monocotyledons, often very brittle, even in a living state. Leaves opposite, ternate or alternate, penninerved, or several-nerved from the base.

Inflorescence usually racemose ; subtending bract of each flower situated at the apex of the pedicel when the latter is present ; flowers often large and brightly coloured, hermaphrodite. Calyx more or less lobed, or truncate, sometimes very short, occasionally provided inside at the base with a fleshy annular thickening (intramarginal ring). Corolla polypetalous or, more usually, gamopetalous, regular or zygomorphic ; tube often split unilaterally for some distance downwards when the flower expands. Filaments united in their lower part with the petals ; anthers introrse, not versatile. Style filiform, or gradually thickened upwards in the upper part and then rather suddenly contracted into a narrow neck below the stigma (skittle-shaped) ; stigma truncate or more or less capitate.

Fruit baccate, usually globose, ovoid or ellipsoid, crowned by the persistent calyx. Seed albuminous ; embryo straight, terete.

*Species* about 500.

*Distribution* :—Old World, mostly tropical and subtropical.

1. *Loranthus curviflorus* Benth. ex Oliv. in Hook. Ic. Pl. t. 1304 ; Engl. in Engl. Bot. Jahrb. XX, 130 ; Engl. Pf. Ost Afr. C. 167 ; Schweinf. et Volk. in Ghika, Pays des Somalis 200 ; Schweinf. in Bull. Herb. Boiss. IV, App. II, 150 ; Sprague in This.-Dyer Fl. trop. Afr. VI, sect. 1, 279.

*Plicosepalus curviflorus* Van Tiegh. in Bull. Soc. Bot. France XLI, 504, 540.

*Arabic name* in the Tehama : Sheker.

*Description* :—Branches spreading ; branchlets slender, more or less nodose, glabrous, soon lenticellate. Leaves opposite, subopposite or alternate, linear, oblanceolate-linear or oblanceolate (more rarely



obovate-oblong), obtuse or rounded at the apex, cuneate at the base,  $\frac{3}{4}$ — $2\frac{1}{2}$  inches long, 2—5 lines broad, rigidly coriaceous, glabrous, 3—5-nerved, nerves indistinct or hidden ; petiole  $\frac{1}{2}$ —1 line long.

Umbels solitary, 4—6-flowered ; peduncle 1—3 lines long ; pedicels 2—4 lines long ; bract elliptic-cupular, or ovate-cupular, dorsal margin  $\frac{3}{8}$  line long, lateral  $\frac{1}{8}$  line, ventral  $\frac{1}{4}$ — $\frac{3}{8}$  line long, more rarely saucer-shaped with a small dorsal lobe, conspicuously umbonate, umbo obtuse or horned. Receptacle campanulate or urceolate,  $1\frac{1}{2}$ — $1\frac{3}{4}$  lines long. Calyx patulous,  $\frac{1}{4}$ — $\frac{3}{8}$  line long. Petals fire-red,  $1\frac{3}{4}$  inches long, reflexed above the middle, with 4—8 (usually 5) pairs of oblique folds arising from the adnate part of the filament. Filaments inserted 4—5 lines above the base of the petals, 6—10 lines long ; anthers linear, slightly tapering downwards, 4—5 lines long. Style broadened into the stigma in the uppermost  $1\frac{1}{4}$ — $1\frac{1}{2}$  lines ; stigma depressed-capitate,  $\frac{3}{8}$ — $\frac{1}{2}$  line in diameter.

*Flowers and fruits* :—In Yemen in January (Schweinf.) ; in Eritrea in February and May.

*Locality* :—Shaikh O'thman on *Acacia spirocarpa* in great quantities (Schweinf., Defl., Yerbury).

*Distribution* :—German East Africa, Nubia, Eritrea, Somaliland, Arabia.

In Yemen the plant grows on *Acacia* and *Zizyphus*.

#### XLVI.—EUPHORBIACEÆ.

Trees, shrubs, or herbs, often with milky juice. Leaves alternate or opposite, rarely divided or compound ; stipules usually small, caducous or persistent, rarely connate in a bud-protecting sheath ; glands sometimes at the apex of the petiole or at the base of the leaf-blade.

Flowers usually small or minute, always 1-sexual ; inflorescence various, usually compound, sometimes (*Euphorbia*) of single naked 1-staminate florets in a perianth-like involucre surrounding a solitary pistil, more commonly the main inflorescence centripetal, axillary or racemose, the subdivisions cymose, sometimes wholly cymose in terminal dichotomous panicles, or reduced to simple clusters or solitary florets. Perianth often small, sometimes obsolete, often dissimilar in the two sexes, usually simple, calycine with valvate or imbricate segments, sometimes calycine and 2-seriate imbricate, with segments all similar or occasionally dissimilar, rarely double, the inner then of 4—5 small scale-like, or very rarely conspicuous petals. Male flowers : Torus sometimes forming an intrastaminal disk or with disk-glands or lobes alternate with the stamens of the outer series. Stamens various, sometimes solitary or fewer than, sometimes as many as the sepals or petals, sometimes

indefinite ; filaments free or connate ; anthers 2-celled, often didymous with longitudinal, transverse or porous dehiscence. Rudimentary ovary present or 0. Female flowers : Sepals usually larger and less connate than in the male. Petals sometimes smaller and less often present than in the male. Disk hypogynous or of discrete glands or 0. Ovary superior, sessile or stipitate, usually of 3 carpels more or less united ; ovules 1—2 in each carpel, pendulous from the inner angle of the cell, the funicle often thickened ; styles as many as the carpels, free or united or entire or divided ; stigmatic surface usually on the inner face of the styles or style-arms.

Fruit usually a capsule of 3 two-valved, 1—2-seeded cocci separating from a persistent axis, or a drupe with 1—3-cells or of one or more combined nuts. Seeds laterally attached at or above the middle of the cells, with or without an aril or caruncle at the hilum ; albumen fleshy ; embryo straight, enclosed in the albumen ; cotyledons flat, leafy, and radicle superior ; albumen rarely absent and cotyledons sometimes fleshy.

*Genera* about 200 ; *species* about 3,000.

*Distribution* : Chiefly tropical, rare in cold countries.

- Tribe I.—Euphorbiae* : Flowers monoëcious ; males numerous, consisting each of a solitary pedicelled stamen, many of which surround a single female, which consists of a solitary pedicelled tricarpellary pistil ; all enclosed in a calyx-like involucre. Raphe of ovule ventral . . . 1. Euphorbia.
- Tribe II.—Phyllanthæ* : Sepals 1—2-seriate. Petals minute or 0. Stamens 1—2-seriate ; outer series opposite the sepals, or all in the centre of the flower. Ovary 2-to many-celled, cells 2-ovuled. Raphe of ovule ventral.  
Only 1 genus represented at Aden . . . 2. Phyllanthus.
- Tribe III.—Crotonæ* : Perianth single, or of the male, or of both sexes double. Stamens 1—2-seriate, outer series alternate with the sepals or central in the flower. Ovary 2-3-celled, cells 1-ovuled.
1. Flowers in androgynous 2—3-chotomous cymes ; leaves usually digitately lobed ; stamens erect . . . 3. Jatropha.
  2. Flowers in androgynous racemes ; leaves not digitately lobed ; stamens inflexed in bud . . . 4. Chrozophora.
  3. Flowers in terminal panicles. Staminal bundles indefinite . . . 5. Ricinus.

### 1. Euphorbia Linn.

Herbs, shrubs, or small trees of various habit, with milky juice ; stems slender and leafy or thick and fleshy and sometimes leafless or nearly so. Leaves opposite or less commonly alternate.

Flowers monoecious, combined in an inflorescence of many male florets surrounding a solitary female, arranged in a common 4-5-lobed perianth-like involucre with thick glands at the mouth, each gland often

bearing a petaloid spreading white or coloured limb. Male flowers a stalked stamen without floral envelope. Female flowers : Ovary 3-celled on an ultimately exerted stalk in the centre of the involucre ; ovule solitary in each cell ; styles 3, free or connate.

Fruit a capsule of 3 bivalved cocci, separating elastically from a persistent axis and dehiscing ventrally or both ventrally and dorsally. Seeds albuminous ; cotyledons broad, flat.

*Species* about 600.

*Distribution* :—Cosmopolitan.

Shrubs or undershrubs :

Mostly aphyllous . . . . . 6. *E. Schimper.*  
With leaves.

Leaves fascicled.

Leaves cuneate-oblong or cuneate ovate or linear . . . 7. *E. cuneata.*  
Leaves obovate-oblong, mucronulate . . . 9. *E. adenensis.*

Leaves not fascicled.

Leaves mucronate.

Leaves alternate,  $\frac{1}{2}$ — $1\frac{1}{2}$  inches long . . . 8. *E. systyla.*  
Leaves opposite,  $\frac{1}{4}$ —1 inch long . . . 2. *E. arabica.*  
Leaves acute, deflexed,  $\frac{1}{4}$  inch long . . . 5. *E. Bottæ.*

Herbs :

Leaves linear, subfalcate, acute, up to  $\frac{1}{2}$  inch long . . . 4. *E. polycnemoides.*  
Leaves obliquely oblong or obovate-oblong, rounded or obtuse at the apex, coriaceous,  $\frac{1}{10}$ — $\frac{1}{5}$  inch long . . . 3. *E. granulata.*  
Leaves obliquely and broadly or narrowly oblong, obtuse, serrulate, not coriaceous,  $\frac{1}{4}$ —1 inch long . . . 1. *E. hypericifolia.*

### *Sectio I.—Anisophyllum.*

**1. *Euphorbia hypericifolia* Linn.** Hort. Cliff. 198 ; Boiss. in DC. Prodr. XV, 2, 23 ; Hook. Exot. Fl. I, t. 36 ; Thwaites Enum. 268 ; Benth. Fl. Hongk. 301 ; Hook. f. Fl. Brit. Ind. V, 249.

*Euphorbia indica* Lamk. Dict. II, 423 ; Boiss. in DC. Prodr. XV, 2, 22, et in Fl. Or. IV, 1086 ; Wall. Cat. 7711, excl. C ; Balf. f. Bot. Socotra, p. 264.

*Euphorbia cassioides* Presl Bot. Bemerk. p. 119.

*Euphorbia decumbens* Willd. Suppl. 27.

*Euphorbia androsæmoides* Dennst. Schlüss. Hort. Mal. 36.

*Euphorbia parviflora* Linn. Syst. ed. X, 1047 ; Roxb. Fl. Ind. II, 472 ; Boiss. in DC. Prodr. XV, 2, 22 ;

*Euphorbia papilligera* Boiss. Cent. Euph. 8.

*Euphorbia ægyptiaca* Anders. Journ. Linn. Soc. V, Suppl. p. 24 (teste Balf. f. ; non of Boiss.).

*Description* :—A rather slender, rarely stout, annual, 6—12 inches high, of various habit, glabrous or sparsely pubescent, erect ascending

or decumbent. Leaves opposite, obliquely broadly or narrowly oblong, obtuse, serrulate, nerves distinct, base rounded or cordate,  $\frac{1}{2}$ —1 inch long, rarely more or less, not coriaceous. Stipules minute, setaceous, lacerate, or 0.

Involucres very minute, turbinate, glabrous, with quite entire minute bracts at the base of the pedicel, in axillary and terminal usually peduncled and many-flowered cymes; glands very shortly stipitate; lobes usually projecting above the glands; limb of the latter white or pale pink, always small but very variable in size, sometimes 0.

Capsule subglobose; cocci more or less pubescent or glabrous. Seeds with a thin mucous coat, bluish when dry, very variable as to the amount and depth of the shallow depressions on the faces which are often obsolete.

*Locality*:—Aden (Hook., Anders., Marchesetti?).

*Distribution*:—Tropics of both hemispheres, except Australia and the Pacific Islands, ascending to 4,000 feet in the Himalaya.

**2. *Euphorbia arabica*** Hochst. et. Steud. in Schimp. Pl. Abyss. n. 756; DC. Prodr. XV, 2, 33; Anders. Journ. Linn. Soc. V, Suppl. p. 34.

*Description*:—A perennial undershrub, up to 1 foot high, erect, glabrous. Stem woody, terete, branching. Leaves opposite, remote or approximate, unequal, linear-lanceolate or ovate-lanceolate, mucronate, glabrous, 2 lines-1 inch long, 1 line broad. Stipules very narrowly lanceolate.

Flowers axillary, mostly solitary; peduncle glabrous, short; involucre pyriform, glabrous, with ovate, fimbriate-ciliate teeth; glands rotund, inside at the base ciliate. Ovary and stipe glabrous; styles divaricate, free at the base; stigmas bifid. Capsule angular; seeds smooth, yellowish-red.

*Flowers and fruits*:—Nov. 1888 (Schweinf.), Dec. 1847 (Hook.), Febr. 1857 (Thomson), March 1878 (Perry), March 1881 (Schweinf.), April 1894 (Lunt).

*Locality*:—Near the sea (Hook.); top of Shum Shum Range between 1,300 and 1,750 feet (Busse); plain of Maala (Defl.); great valley between Steamer-Point and town (Marchesetti); near the Telegraph Office, nearly sea-level (Lunt); without locality (Hildebrandt, Schweinf., Wichura, Beevor, Birdw., Perry).

*Distribution*:—Nubia, Abyssinia, Jidda, Yemen, Angola, Natal.

*Note*:—Schweinfurth (Bull. Herb. Boiss. (1899) Append. II, p. 313) calls his specimens collected at Aden *var. brevifolia* Boiss. in DC. Prodr. XV, 2, p. 33. He describes his plant as follows:

"A plant about  $1\frac{1}{3}$  feet high, broom-like, with long shoots, dichotomously branched, basal parts and roots strongly woody. Leaves oblong or linear, mostly rounded at both ends, but often pointed,  $\frac{1}{10}$  by  $\frac{1}{4}$  or  $\frac{1}{12}$  by  $\frac{1}{2}$  inch, with a much rougher structure than the common form, which probably represents the annual type. The involucral glands, style, and seed correspond, in spite of the great differences in the habit of the plant, with the characteristics of the typical form."

**3. *Euphorbia granulata*** Forsk. Fl. Aeg.-Arab. 94; Vahl. Symb. II, 54; Boiss. Fl. Or. IV, 1087, et DC. Prodr. XV, 2, p. 33; Hook. Fl. Brit. Ind. V, 252; Cooke Fl. Bomb. Pres. II, 569.

*E. Forskalii*, var.  $\beta$ . et  $\gamma$ . J. Gay in Webb. Phyt. Canar. III, 242.

*E. fragilis* Dene. in Ann. Sc. Nat. ser. 2, (1834), 241.

*E. arillata* Edgew. in Journ. As. Soc. Beng. vol. 16, 1218 (*vide* Hook. f.)

*E. villosa* Herb. Royle.

*E. thymifolia* Wall. Cat. 7710, E.

*Anisophyllum Forskalii* Klotzsch et Garcke in Bot. Reise Prz. Wald. Bot. 25.

var. **glabrata** Boiss. in DC. Prodr. XV, 2, p. 34; Schweinf. in Bull. Herb. Boiss. VII, Append. II, 314.

*Arabic name*:—Lébbena, Um-el-lebben (Schweinf.).

*Description*:—A small slightly hairy plant with a perennial root, stems many from the root, prostrate, leafy, 3—6 inches long, less brittle than the typical plant. Leaves opposite, coriaceous,  $\frac{1}{10}$ — $\frac{1}{5}$  by  $\frac{1}{20}$ — $\frac{1}{8}$  inch, obliquely oblong or obovate-oblong, rounded or retuse at the tip, quite entire, base narrow or rounded or subcordate, the upper ones glabrate; petioles short; stipules minute, ciliolate.

Involucres minute, axillary and on short leafy branchlets, subsessile, turbinate,  $\frac{1}{20}$  inch long; gland usually without a limb.

Capsule  $\frac{1}{15}$  inch in diameter; cocci hirsute, rounded at the back, not keeled; styles very short, 2-fid. Seeds quadrangular, bluntly pointed,  $\frac{1}{20}$  inch long, faintly pitted; testa very mucous when wetted.

*Flowers and fruits*:—April 1894 (Lunt).

*Locality*:—Gravelly slope of Shum Shum Range (Ellenbeck); Plain of Maala, nearly sea-level (Lunt); without locality (Edgew.); Little Aden (Defl.).

*Distribution* (of the species):—Cape Verd Islands, Canaries, Morocco, Algeria, Sinai, Egypt, Nubia, Kordofan, Darfur, Central and Southern Arabia; N. Somaliland, S. Persia, Afghanistan, Punjab, Sind.

4. **Euphorbia polynemoides** Hochst. in Kotschy Pl. Nub. n. 184; DC. Prodr. XV, 2, p. 47; Schweinf. in Bull. Herb. Boiss. vol. VII, Append. II, 315.

*Description*:—A glabrous, glaucescent, reddish herb, about 6 inches high and more; stem erect, slightly rigid, dichotomously branched. Leaves subsessile, linear, subfalcate, acute, very unequal at the base, serrulate in the upper part, the larger ones 6 lines long and scarcely  $1\frac{1}{2}$  lines broad at the base; stipules subulate, reddish.

Involucres axillary, red, turbinate, forming slender racemes which are intermixed with subentire leaves, the throat and triangular lobes ciliolate. Glands transversely ovate, slightly concave, with a rose-coloured equilateral 2—3-lobed appendage.

Cocci of capsule carinate; seed grey, ovate, acutely tetragonous, deeply sulcate at the base, scrobiculate on account of the furrows anastomosing with each other.

*Flowers and Fruits*:—March (Schweinf.).

*Locality*:—Above the coal-depôt of the Messag. Marit. on rocks of basaltic lava (Schweinf.); Koosaf Valley (Defl.); without locality (Birdw.).

*Distribution*:—Abyssinia, Kordofan, Usambara.

#### *Sectio II.—Tirucalli.*

5. **Euphorbia Bottæ** Boiss. in DC. Prodr. XV, 2, p. 95.

*Description*:—Shrubby, much-branched; branches  $\frac{1}{2}$ –1 foot long, slender, virgate; leaves distant, narrowly lanceolate, acute, deflexed, early deciduous, 3 lines long.

Involucres 1–4, terminal, unequally pedunculate (6–10 lines), umbellate, supported by 2 oblong acuminate leaflets, the hemispherical lobes broadly ovate, denticulate-ciliate. Glands large, transversely ovate, styles long, bifid, with the branches revolute and scarcely thickened at the apex.

Capsules whitish, ovate, deeply trisulcate, larger than a pea, long-stipitate; cocci suberose, subcarinate; seed ovate, smooth, with the minute caruncle much depressed.

*Locality*:—Aden (Defl.).

*Distribution*:—Arabia, at Jennat and Jebel Ras (Botta).

6. **Euphorbia Schimperii** (Forsk.) Presl. Bot. Bemerk. 109; Anders. Journ. Linn. Soc. V, Suppl. p. 34; Boiss. in DC. Prodr. XV, 2, 96.

*Euphorbia Tirucalli* Forsk. Fl. Aeg.-Arab. 112.

*Euphorbia Larica* Boiss. Cent. Euph. 24, et in DC. Prodr. XV, 2, 96.

*Arthrothamnos Schimper* Schweinf. in Herb. Nub. n. 924.

*Arabic name* :—Rummid.

*Description* :—A shrub, generally aphyllous, fleshy, pale-green. Branches erect, patulous, terete, fleshy, trichotomous. Leaves rarely present, deciduous, 1—3 at the end of the branchlets, minute, 3—5 lines long, 2 lines broad, herbaceous, glabrous, ovate, acute, entire.

Peduncles 4—5, at the end of the branches, short, 3 lines long, terete, thick-fleshy, 4-flowered. Involucre green, campanulate; teeth obtuse, fimbriate, shorter than the glands; glands 5, yellow, concave. Flowers short-pedicelled, umbellate, bibracteate; bracts ovate, acute, truncate at the base, subherbaceous, entire. Stamens 20, some of them exerted; anthers yellow. Ovary stipitate, glabrous; styles united below the middle; stigmas thickened, bifid.

*Locality* :—Plain of Maala, Koosaf Valley (Defl.); Shum Shum Range at about 850 feet (Busse, Ellenbeck ex Krause); without locality (Hook., Thomson, Anders.).—Forms densely branched bushes of 3—5 feet in height.

*Distribution* :—Nubia, Abyssinia, C. and S. Arabia, Persia, Socotra, coast of Somaliland.

*Note* :—There are three specimens from Aden in the Herb. Kew labelled '*Euphorbia Schimper* Presl.,' which evidently do not belong to this species. One was collected by Balfour in Jan. 1880, the second by Schweinfurth in March 1881, and the third by the same botanist in Dec. 1888.

Mr. N. E. Brown of the Royal Botanic Gardens, Kew, informed me that the specimens do not belong to any of the tropical African species; but the materials are not sufficient to describe a new species.

### *Sectio III.—Lyciopsis.*

**7. *Euphorbia cuneata*** Vahl. Symb. II, 53; DC. Prodr. XV, 97; Anders. Journ. Linn. Soc. V, Suppl. p. 35.

*Euphorbia fruticosa* Edgew. Journ. Asiat. Soc. Beng. XVI, 1219.

*Description* :—An arborescent shrub, 6—10 feet high, glabrous. Stem woody; cortex cinereous-glabrous; branches rectangular, spinescent, few-leaved, puberulous when young. Leaves in fascicles on tubercles, 2—8 lines long, 1—3 lines broad, cuneate-oblong, cuneate-ovate or linear, obtuse at the apex or obscurely bilobed, attenuate at the base, sessile, sometimes petiolate, puberulous on both sides.

Peduncles arising from the leaf-bearing tubercles, fleshy, terete, puberulous, 3—4-bracteate, 4-flowered; involucre green, campanulate, tomentose, with 5 cuneiform fimbriate teeth; glands 5, yellow, concave-peltate, glabrous. Flowers umbellate, 1 central and sessile, 3

pedicellate; pedicels as long as the peduncle but more slender. Stamens numerous. Ovary stipitate, tomentose; styles half-way up united, subentire at the apex.

*Flowers and fruits*:—Jan. 1863 (Oliver and Cl.), Jan. 1872 (Thomson), Jan. 1880 (Balf.), April 1861 (Thomson), May 1850 (Madden), Nov. 1888 (Schweinf.), Dec. 1847 (Hook.), Dec. (Defl.).

*Locality*:—Goldmore Valley (Defl.); ravine above the European cemetery of Steamer-Point (Schweinf.); along the path leading to the Shum Shum Range (Busse); without locality (Edgew., Hook., Madden, Anders., Hildebrandt, Balfour, Birdw., Kuntze).

*Distribution*:—Yemen, Eritrea, N. Somaliland.

*Note*:—Schweinfurth (in Bull. Herb. Boiss. VII (1899), Append. II, 317) calls his specimens which he collected in the ravine above the European cemetery of Steamer-Point in the year 1888: *Euphorbia cuneata* Vahl. var.  $\beta$ . *Perrottetii* Jaub. et Spach.

As a matter of fact, the plant described as *Euphorbia Perrottetii* Jaub. et Spach (Illustr. Pl. Or. vol. V, tab. 464) was found at Aden: "Arabia Felici, prope oppidum Aden, legit cel. Perrottet, Martio anni 1854 (Herb. Mus. Par.)."

#### *Sectio IV.—Pseudacalypha.*

**8. *Euphorbia systyla*** Edgew. Journ. Asiat. Soc. Beng. XVI, 1218; Anders. Journ. Linn. Soc. V, Suppl. p. 35; DC. Prodr. XV, 98.

*Description*:—An undershrub, 2-3 feet high, erect, dichotomous, striate, subglaucous, more or less leafed. Branches angular, ascending. Leaves alternate, petiolate, lanceolate or linear-lanceolate, entire mucronate, puberulous,  $\frac{1}{2}$ — $1\frac{1}{2}$  inches long, 1—3 lines broad; petiole 6 lines long.

Flowers axillary, solitary, sessile; involucre tubular, persistent, 4-dentate; teeth fimbriate, alternate, with 4 concave glands. Ovary pubescent; stipe thickened, tomentose; styles united up to the apex; stigmas bifid.

Capsule erect, subglobose, puberulous; cocci bisulcate, angular, angles rounded. Seeds conical, compressed, constricted; testa crustaceous, punctate, olivaceous.

*Flowers and fruits*:—February 1851 (Thomson), March 1850 (Madden), April 1861 (Thomson), June 1872 (Hildebr.), Dec. 1847 (Hook.), Dec. 1889 (Defl.).

*Locality*:—From the seashore up to 1,000 feet of the Shum Shum Range (Edgew., Hook., Thomson, Madden); plain of Maala (Schweinf., Defl.); Biggari Valley (Defl.); upper end of the great valley between



Steamer-Point and town (Marchesetti); without locality (Hildebrandt, Balfour, Birdw., Kuntze); common (ex Krause).

*Distribution* :—Tehama, coast of N. Somaliland.

*Section V.—Trithymalus.*

**9. Euphorbia adenensis** Defl. Bull. Soc. Bot. France IX, 67; Schweinf. Bull. Herb. Boiss. VII, App. II, 329.

*Description* :—A shrub, 4—5 feet high, glabrous, dichotomously branched from the base. Branches terete, thick, woody-fleshy, entirely denudate, unarmed, remotely cicatricose; cortex grey-cinereous. Leaves deciduous, in terminal fascicles, alternate, sessile, exstipulate, entire, obovate-oblong, obtuse, mucronulate, attenuate at the base, 8—9 lines long, 2—3 lines broad, pale-green.

Involucre terminal, subsessile, campanulate; lobes 5, orbicular, small, fimbriate; glands 5, patent, transversely ovate, plane, exappendiculate, with the margin sometimes subrevolute. Flowers diœcious (by abortion?). Male flowers ∞-capitate in the involucre, pedicellate, bracteolate; pedicel  $1\frac{1}{2}$  lines long; bracteoles paleæform, palmately laciniate, fimbriate, as long as the pedicels; perianth obsolete; filaments thick, 3—4 times shorter than the pedicel. Female flower 1, solitary in the centre of the involucre, sessile, surrounded by 1 minute, annular, fimbriate bracteole. Ovary glabrous; styles united, dividing at the middle into 2 circinate lobes.

Capsule spherical, 3—4 lines in diameter, apiculate with the persistent styles, finally very shortly stipitate; cocci crustaceous, rotundate on the back. Seeds globose, 1 line in diameter, smooth, yellow, ecarunculate.

*Flowers and fruits* :—December (Schweinf.).

*Locality* :—Goldmore Valley, near the Flagstaff, rare (Defl.); near the top of the Shum Shum Range at about 1,700 feet (Schweinf.); without locality (Birdw.).

*Distribution* :—Yemen, Hadramaut.

*Note* :—As to the systematic position of *Euphorbia adenensis* Defflers says: "Species insignis in sectione 'Trithymalo' inter 'Pachycladas' ut videtur collocanda, sed ramis denudatis crassis et cymis terminalibus ad capitula solitaria reductis ad sectionem Euphorbium, subsect. Tirucalli Benth. et Hook. accedens."

**2. Phyllanthus Linn.**

Herbs, shrubs or trees. Leaves bifarious or distichous, alternate, entire, the branchlets with their leaves often resembling pinnate leaves, stipules usually narrow or 0.

Flowers small, monœcious, rarely diœcious, axillary or on old nodes; males usually many, fascicled, subsessile or pedicellate, rarely few or solitary; females in the same or distinct axils with longer pedicels, solitary or few. Perianth simple. Male flowers: Sepals 4—6, free or very shortly connate, imbricate and more or less 2-seriate. Disk glandular, (rarely 0). Stamens 3 (rarely 4—5), in the centre of the flower; filaments free or connate; anthers 2-celled, oblong or didymous (rarely reniform), the cells parallel or diverging; dehiscence extrorse, vertical or transverse. Pistillode 0. Female flowers: Sepals as in the male. Petals 0. Ovary usually 3-celled; ovules 2 in each cell; styles free or connate, usually bifid, with slender arms, rarely dilated.

Fruit of 3 crustaceous or coriaceous (rarely bony) 2-valved cocci with or without a separable coriaceous (rarely fleshy) epicarp, sometimes a 4-celled berry or a drupe with a 3—4-celled bony endocarp. Seeds 3-gonous; testa crustaceous; hilum without a strophiole; albumen fleshy; cotyledons flat or flexuous.

*Species* about 400.

*Distribution* :—In all warm countries.

**1. *Phyllanthus maderaspatensis*** L. Sp. Pl. p. 982; Müll.-Arg. in Linnæa XXXII, 19 et. DC. Prodr. XVI, 362; Benth. Fl. Austr. IV, 103; Hook. Fl. Brit. Ind. I, 293.

*Phyllanthus andrachnoides* Willd. Sp. Pl. IV, 575.

*Phyllanthus obcordatus* Willd. Enum. Hort. Berol. Suppl. p. 65.

*Phyllanthus javanicus* Poir.; Spreng. Syst. III, 21.

*Phyllanthus anceps* Herb. Heyne.

*Phyllanthus linearis* Herb. Madr.

*Phyllanthus malabaricus* Herb. Wight.

*Phyllanthus niruri* Wall. Cat. 7894.

*Arabic name* :—Cholf.

*Description* :—Annual, but sometimes woody at the base, very variable in habit; stems glabrous, 1—3 feet long, erect, ascending or decumbent. Leaves scattered, variable,  $\frac{1}{4}$ — $1\frac{1}{4}$  by  $\frac{1}{8}$ — $\frac{5}{8}$  inch, glabrous, obovate-cuneate, rounded, truncate or somewhat obcordate at the apex, mucronate, much tapering into a very short petiole, glaucous and with a few lateral nerves conspicuous beneath; stipules peltate, lanceolate, very acute.

Flowers axillary, the male flowers minute in small clusters, subsessile, the female larger, solitary, shortly pedicellate. Sepals 6, obovate, obtuse, green with white margins. Stamens 3; filaments connate. Styles 3, distinct, very small, 2-lobed.

Capsules  $\frac{1}{8}$  inch in diameter, depressed-globose, glabrous, 3-lobed. Seeds  $\frac{1}{16}$  inch long, 3-gonous, rounded on the back, muriculate in five lines.

*Flowers and fruits* :—November 1888 (Schweinf.).

*Fruits* :—March 1878 (Perry).

*Locality* :—Goldmore Valley (Defl.) ; near the Telegraph-Office of Steamer-Point (Schweinf.) ; without locality (Birdw.).

*Distribution* :—Cape Verd Islands, Senegambia, Guinea, Angola, Nubia, Abyssinia, Eritrea, Kordofan, Somaliland, S. Arabia, drier parts of India, Ceylon, Java, China, Australia.

*Note* :—Schweinfurth (in Bull. Herb. Boiss. Vol. VII, Append. II, p. 304) considers his specimens collected at Aden as representing the variety *β. Thonningii* Müll.-Arg. in Linnæa, Vol. 32, p. 19.

Müller gives the following characteristics of his variety : “foliis basi minus cuneato-angustatis apiceque minus abrupte terminatis superioribus interdum fere linearibus.”

Müller's variety *β. Thonningii* is identical with the following :

*Phyllanthus Thonningii* Schum. & Thonn. Beskr. Guin. Pl. 418.

*Phyllanthus arabicus* Hochst. ex Steud. Nom. ed. 2, II, 326.

*Phyllanthus venosus* Hochst. ex A. Rich. Tent. Fl. Abyss. II, 254.

*Phyllanthus longifolius* E. Mey., *non* Lam.

### 3. *Jatropha* Linn.

Herbs, shrubs or trees, often glandular or prickly. Leaves alternate, often digitately lobed ; stipules often ciliate.

Flowers monœcious, in terminal cymes, the central flowers in the cyme or its forks usually female. Perianth usually double. Male flowers : Calyx 5-lobed or-partite, the segments often coloured, imbricate. Petals 5, free or connate. Disk entire or of 5 glands. Stamens numerous ; filaments of all or of the interior only connate below ; anthers erect, ovate or oblong, the cells parallel, contiguous. Pistillode 0. Female flowers : Calyx as in the male. Petals sometimes absent. Ovary 2—4-celled ; ovules solitary in each cell ; styles connate below, 2-fid above, the lobes entire or again 2-lobed.

Fruit a capsule of 2—4 cocci ; cocci 2-valved ; endocarp crustaceous or hard. Seeds ovoid or oblong ; testa crustaceous ; albumen fleshy ; cotyledons broad, flat.

*Species* about 160.

*Distribution* :—Warmer regions, chiefly American and African.

<i>Stipules aculeate-indurate</i>	. . . . .	1. <i>J. spinosa</i> .
<i>Stipules not aculeate-indurate</i>	. . . . .	2. <i>J. lobata</i> .

**1. *Jatropha spinosa*** (Forsk.) Vahl Symb. I (1790) 79; Anders. Journ. Linn. Soc. V, Suppl. p. 36; Pax in Engler's Regni Veg. Consp. 42. Heft (IV, 147) p. 55.

*Croton spinosus* Forsk. Fl. Aeg.—Arab. (1775) p. 163.

*Jatropha aculeata* F. G. Dietr. Lexicon Gaertn. u. Bot. Nachtr. IV (118) 76; Muell.-Arg. in DC. Prodr. XV, 2, (1866), 1083.

*Adenoropium spinosum* Pohl Pl. Bras. Ic. et Descrip. I (1827), 15.

*Arabic name*:—Badr-es-Simssim.

*Description*:—An arborescent shrub, 7—8 feet high, erect, glabrous, with a milky juice. Branches thick-fleshy, terete; cortex cinereous-glaucous or purplish. Petioles slender, 1—1 $\frac{3}{8}$  inches long. Leaves 1 $\frac{1}{2}$ —2 $\frac{2}{5}$  inches long and broad, often broader than long, alternate, petiolate, rotundate, 5—7-nerved, subtruncate-cordate at the base, glaucescent, glabrous, 3—5-lobed or obscurely 7-lobed; lobes rotundate-obtuse, emarginate or subretuse, entire or spinulose-denticulate, stipules sharp-spinose,  $\frac{1}{8}$ — $\frac{1}{4}$  inch long, black or glaucous.

Cymes with elongate peduncles, terminal, dichotomous, lax, glabrous, multiflowered, 4—5 inches long. Bracts small, dilate at the base, acute, scarious, entire,  $\frac{1}{12}$  inch long. Flowers yellowish-green (Forsk. calls them '*coccineos*'), mostly subsessile, monœcious. Sepals 5, glabrous, lanceolate-ovate, obtuse, in the male flowers  $\frac{1}{12}$  inch long, in the female only slightly longer. Petals 5, twice or thrice as long as the calyx. Glands of the disk free. Stamens 8, monadelphous. Ovary sessile, glabrous; styles convolute, 3, free; stigmas peltate.

Capsules  $\frac{2}{5}$  inch long, greyish-yellow, glabrous, verruculose, woody, trilocular. Cocci monospermic. Seeds light brown; caruncle palmately-lacerate.

**Var. *α. genuina*** Pax in Engler's Regni Veg. Consp. Heft 42 (IV, 147) p. 56.

The leaves are larger, 1 $\frac{3}{5}$ —2 $\frac{2}{5}$  inches long and longer and as broad; lobes obtuse or retuse, entire.

*Locality*:—Goldmore Valley (Schweinf., Lunt); Shum Shum Range at 650—1,650 feet (Ellenbeck, Busse); without locality (Balfour, Hildebrandt).

*Distribution*:—S. Arabia, N. African Steppe-province.

**Var. *β. crenulata*** Pax l. c. p. 56.

Lobes rotundate or acute, crenulate-dentate.

*Locality*:—Maala (Hirsch, Schweinf.).

*Distribution*:—S. Arabia, N. African Steppe-province.

*Flowers and fruits*:—Nov. 1888 (Schweinf.), Dec. 1847 (Hook.), Dec. 1889 (Defl.), Jan. 1880 (Balfour), Febr. 1851 (Thomson), March 1881 (Schweinf.).

**2. *Jatropha lobata* (Forsk.) Müll.-Arg. in DC. Prodr. XV, 2 (1886) 1085. Subsp. I. *glauca* (Vahl) Pax in Engler's Pflanzenreich Heft 42 (IV, 147) p. 32.**

*Croton lobatus* Forsk. Fl. Aegypt.-Arab. (1775) 162.

*Jatropha glauca* Vahl Symb. I (1790) 78 (*ex parte*); Rich. Tent. Fl. Abyss. II (1851) 250; Schweinf. Beitr. Fl. Aethiop. (1867) 37.

*Jatropha ricinifolia* Fenzl in Kotschy Pl. Aethiop. n. 251.

*Jatropha lobata* var. *genuina* Müll.-Arg. in DC. Prodr. XV, 2 (1866) 1085.

*Jatropha lobata* var. *Richardiana* Müll.-Arg. in DC. Prodr. XV, 2 (1866) 1086.

*Adenoropium glaucum* Pohl Pl. Bras. Ic. et Descr. I (1827) 15.

*Arabic name*:—Tambakshi ghulghul (Hille); Mjershe (Pax l. c.)

*Description*:—Shrub or undershrub, about 3—8 feet high; branches ascending, woody, overhanging towards the ends. Petioles  $1\frac{2}{5}$ —2 inches long, eglandular; limb cuneate-acute or subtruncate at the base, glabrous or glabrescent,  $2\frac{2}{5}$  inches broad and slightly shorter, 3—5-lobed almost to the middle, glaucous; lobes acute or rotundate-obtuse, irregularly and rather coarsely dentate, the central lobe  $1\frac{1}{5}$ — $1\frac{3}{5}$  inches broad; stipules of the shape of glanduliferous laciniae, simple or bipartite.

Cymes shortly pedunculate, small-flowered; bracts lanceolate or triangular-ovate, glanduloso-subciliate or subentire, eglandular. Flowers small, about  $\frac{1}{8}$  inch long, lutescent or yellow. Sepals of male flowers ovate, crenate or entire, of female flowers lanceolate, acuminate, glanduloso-ciliate; filaments 8, the outer ones shorter, the inner ones longer and monadelphous. Ovary glabrous.

Capsule glabrous, rough-tuberculate, about  $\frac{2}{5}$  inch long. Seed smooth, grey, brown-marbled; caruncle palmate-sulcate.

*Fruits*:—March (Schweinf.).

*Locality*:—Plain of Maala (Schweinf.).

*Distribution* (of the subspecies):—Kordofan, Nubia, Abyssinia, British Somaliland, Eritrea, Arabia.

Subspecies II *senegalensis* (Müll.-Arg.) Pax is confined to Senegambia and Benguela, whilst

Subspecies III *aceroides* Pax et K. has been found in Nubia only between Suakin and Berber.

*Note* :—The plant is full of a colourless astringent juice which stains white blotting-paper red and iron black (Schimper).

#### 4. *Chrozophora* Neck.

Diffuse densely hispid or stellately tomentose herbs. Leaves alternate, sinuate-toothed or lobed, wavy or plicate, 2-glandular at the base.

Flowers monœcious, in axillary bracteate racemes, the males crowded in the upper part of the raceme, the females solitary, pedicellate, in the lower part. Male flowers: Calyx globose or ovoid, splitting into 5 valvate segments. Petals 5, short. Disk obscure. Stamens 5—15; filaments connate below in a column in 1—3 series; anthers oblong, the cells parallel, contiguous. Pistillode 0. Female flowers: Sepals 5, narrow. Petals 5, very narrow, sometimes setaceous or obsolete. Disk of 5 short broad glands alternating with the petals. Ovary 3-celled; ovule solitary in each cell; styles erect or spreading, 2-fid.

Capsule of 3 hispid, tomentose or lepidote, 2-valved, almost fleshy cocci. Seeds estrophiolate; testa shining; albumen fleshy; cotyledons broad, flat.

*Species* about 6.

*Distribution* :—Mediterranean, Asiatic, and African.

**1. *Chrozophora obliqua*** (Forsk.) Juss. Monogr. Euph. p. 28; DC. Prodr. XV, 749; Boiss. Fl. Or. IV, 1141; Hook. Fl. Brit. Ind. V, 409.

*Chrozophora tinctoria* Muell.-Arg. in DC. Prodr. XV, 2, 749.

*Chrozophora oblongifolia* A. Juss., Spreng. Syst. III, 850; Anders. Journ. Linn. Soc. V, Suppl. p. 36.

*Croton obliquus* Vahl Symb. I, 78.

*Croton oblongifolius* Del. Fl. d' Eg. p. 139, t. 51, fig. 1.

*Croton argenteus* Forsk. Fl. Aeg.-Arab. p. 75.

*Croton tinctorius* Wall. Cat. 7716, G.

*Arabic name* :—Tenun.

*Description* :—Shrubby, erect or suberect, much-branched, thickly stellately tomentose. Leaves 1—2 by  $\frac{1}{2}$ — $\frac{3}{4}$  inch, ovate or ovate-lanceolate, sinuate-toothed, subobtusely, clothed on both sides with stellate tomentum, base rounded or cuneate, usually 2-glandular; main nerves few, prominent beneath; petioles  $\frac{1}{4}$ —1 inch long; stipules linear, soon falling.

Flowers in axillary bracteate racemes, the males in the upper part sessile, the females in the lower part pedicellate; bracts linear, hairy,  $\frac{1}{10}$  inch long. Male flowers: Calyx  $\frac{1}{8}$ — $\frac{1}{6}$  inch long, densely stellately

tomentose. Petals thin, membranous,  $\frac{1}{10}$  inch long. Stamens 5. Female flowers : Sepals  $\frac{1}{10}$  inch long by  $\frac{1}{30}$  inch wide at the base, triangular, very acute, stellately tomentose. Petals as the sepals but much narrower and shorter, stellately tomentose. Ovary clothed with stellate tomentum and silvery scales ; styles 3, erect,  $\frac{1}{10}$  inch long, 2-fid to about  $\frac{1}{2}$  way down, stellately tomentose outside.

Capsules  $\frac{1}{4}$  inch in diameter, clothed with stellate tomentum and silvery scales. Seeds roughly tuberculate.

*Locality* :—Plain of Maala, ravine near the mosque of Shaikh Idrus (Schweinf.); Biggari Valley (Defl.); upper end of the great valley between Steamer-Point and town (Marchesetti); without locality (Hook., Hildebrandt, Birdw.).

*Distribution* :—Sinai, Egypt, Nubia, Libya, Abyssinia, Kordofan, Somaliland, Socotra, Central and S. Arabia, Muscat, Sind, Punjab, Kashmir.

### 5. *Ricinus* Linn.

A tall glabrous annual, sometimes shrubby or subarborescent. Leaves alternate, broad, palmately 7-many-lobed, serrate.

Flowers large, in terminal subpanicled racemes, monœcious, apetalous upper male crowded, lower female. Disk 0. Male flowers : Calyx membranous, splitting into 3—5 valvate segments. Stamens very many, filaments crowded, variously connate or in branching clusters ; anther-cells distinct, distant, subglobose, divergent. Pistillode 0. Female flowers : Calyx spathaceous, caducous. Ovary 3-celled ; styles short or long, spreading, often very large, entire 2-fid or 3-partite, feathery papillose ; cells 1-ovuled.

Capsule of 3 bivalved cocci. Seeds oblong ; testa crustaceous ; albumen fleshy ; cotyledons broad, flat.

#### *Species.*

*Distribution* :—Tropics generally, probably indigenous in Africa.

**1. *Ricinus communis* L. Sp. Pl. 1007 ; Muell.-Arg. in DC. Prodr. XV, 2. 1017.**

*Ricinus inermis* Jacq. Ic. Rar. I, t. 195.

*Ricinus lividus* Jacq. Ic. Rar. I, t. 196.

*Ricinus speciosus* Burm. Fl. Ind. 307, t. 63, f. 2.

*Ricinus spectabilis* Blume Bijl. 623.

*Ricinus viridis* Willd. Hort. Berol. t. 49.

*Croton spinosus* Linn. Sp. Pl. 1005.

*Names* :—Khirva, Gar (Arabic), Castor-oil Plant, Palma Christi, Ricin de Palma Christi.

*Locality* :—Shaikh O'thman (Defl.). Probably naturalized.

We mention in this place a plant which Deflers found in the central part of the crater, south of the path leading to the Flagstaff in a ravine opening on the great reservoirs.

Having seen one specimen only, and this very incomplete, Deflers is doubtful even with regard to the natural order to which this plant might belong. Judging from the position and form of the inflorescence he thought, the specimen looked very much like a certain *Antidesma* of Kordofan, of which he had seen specimens in Schweinfurth's herbarium. But Baillon, who also examined the plant, seems to have detected some better founded analogies with the genus *Acalypha*, without, however, arriving at a definite conclusion. In order to draw the attention of botanists to this probably undescribed species, we do not consider it superfluous, to repeat here Deflers' description.

"Suffruticosa, dumulosa, a collo ramosissima; ramis erectis, elongatis, inermibus, lignosis, foliosis, adpresse sericeis, cortice rubro; foliis sparsis, exstipulatis, breviter petiolatis, lineari-ellipticis, obtusis, basi attenuatis, uninerviis, integris, velutinis, ad nervum et petiolum purpurascens; floribus (masculis?) bracteatis, in spicas tenues amentiformes, folio oppositas et eo 2—3-plo longiores, dispositis; rhachide filiformi, velutino, purpurascens; bracteis crebris minutis, sessilibus, orbiculatis, valde concavis, hirtis, persistentibus.

"1½-pedalis; folia 3—5 lin. long, ½—¾ lin. lat.; petioli vix ¼—½ lin. longi."

#### XLVII.—URTICACEÆ.

Herbs, shrubs, or trees. Leaves usually alternate, often oblique; stipules various.

Flowers cymose or clustered, usually minute, monœcious or diœcious, 1-sexual, hermaphrodite, or rarely polygamous, often crowded on the surface of a fleshy flat concave or globose receptacle, sometimes hollow and closed; bracts usually small or 0, sometimes 2—4 or more, involucrate. Perianth simple, calycine, regular or irregular, equally or unequally toothed, lobed or partite; segments imbricate or valvate. Disk hypogynous, obscure or 0. Stamens as many as and opposite to the perianth-lobes, sometimes adnate to their base (rarely fewer or more); filaments free or rarely connate at the base; anthers 2-celled. Pistillode in male flowers small or 0. Ovary superior, 1-celled; ovule solitary; style often excentric, simple or 2-fid with stigmatic arms, or stigma sessile, plumose or penicillate.

Fruit simple, indehiscent, a drupe or samara, or of free achenes, or compound in a confluent mass of perianths and pericarps. Seed erect,

<sup>1</sup> Deflers, A. In Bull. Soc. Bot. de France, Vol. 34, p. 68.



lateral or pendulous ; testa membranous ; albumen copious, scanty or 0 ; embryo straight or curved.

*Genera* 109 ; *species* about 1,500.

*Distribution* :—Throughout both hemispheres.

### 1. Forskohlea Linn.

Herbs, sometimes woody at the base. Leaves alternate, toothed, 3-nerved, often hoary beneath ; stipules lateral, free.

Flowers monœcious, aggregated in a tubular or campanulate 3—6-partite androgynous involucre which is densely woolly within, the male flowers numerous on the periphery of the involucre, the female flowers 1—5 in its centre. Male flowers : Perianth clavate in bud, in flower irregularly split, 3-lobed or 3-toothed, 1 lobe inflexed. Stamen 1. Pistillode 0. Female flowers : Perianth 0. Ovary straight ; ovule erect ; stigma filiform, hispid, persistent.

Achenes enclosed in the involucre, enveloped in wool, ovate, compressed ; testa membranous ; albumen scanty or 0 ; 3 tyledons broad.

*Species* 5.

*Distribution* :—Spain, Africa, Arabia, India

Suffruticose, with rhombic, elliptic, orbicular or obovate leaves	.	.	1. <i>F. tenacissima</i> .
An annual green herb with ovate lanceolate or lanceolate leaves	.	.	2. <i>F. viridia</i> .

**1. *Forskohlea tenacissima* L.** Mant. p. 72 ; DC. Prodr. XVI, 1. 235<sup>55</sup> ; Anders. Journ. Linn. Soc. V, Suppl. p. 36 ; Boiss. Fl. Or. IV, 115 ; Hook. Fl. Brit. Ind. V, 593 ; Batt. et Trab. Fl. d'Alg. p. 812.

*Forskohlea latifolia* Retz. Observ. p. 51.

*Caidbeya adhærens* Forsk. Fl. Aeg.-Arab. p. 82.

*Arabic Name* :—Lessike.

*Description* :—Suffruticose ; stem 6—24 inches high. Leaves  $\frac{1}{2}$ — $1\frac{3}{4}$  by  $\frac{3}{8}$ — $1\frac{1}{2}$  inches, variable in shape and size, rhombic, elliptic, orbicular, or obovate, obtuse, toothed or serrate, softly hairy with hooked hairs above, white-wooly beneath, base cuneate ; petioles  $\frac{1}{4}$ — $1\frac{1}{4}$  inches long ; stipules ovate, acute, scarious, ciliate.

Flowers monœcious, in axillary androgynous membranous involucre, the males at the margin, the females 1—4 in the centre of the involucre ; bracts usually 5, foliaceous, lanceolate, hispid above, silky below, reaching nearly  $\frac{1}{4}$  inch long. Male flowers : Perianth unequally 3-lobed. Stamen 1. Female flowers : Perianth 0.

Achenes  $\frac{1}{10}$ — $\frac{1}{8}$  inch long, ovoid, compressed, tapering into the filiform style.

*Flowers* :—March 1878 (Perry), August 1898 (Birdw.), Dec. 1847 (Hooker).

*Fruits* :—March 1878 (Perry), Dec. 1847 (Hooker).

*Locality* :—Goldmore Valley, above the coal depôt of the Messag. Marit. (Schweinf.); "in locis depressis, rarissime" (Hook.); without locality (Defl., Birdw.); common on rocks (Perry).

*Distribution* :—S.-E. Spain, Teneriffe, N. Africa, Arabia, Afghanistan, Western Punjab, Sind.

**2. *Forskohlea viridis*** Ehrbg. in Wedd. Monogr. Urtic. p. 537; DC. Prodr. XVI, 1,235<sup>56</sup>; Franch. Sert. Somal. in Miss. Révoil. p. 65; Hiern Cat. Afr. Pl. part IV, p. 994.

*Chamaedryfolia viridis* O. Kuntze Rev. Gen. Pl. II, p. 625, (1891).

*Description* :—An annual, erect, herbaceous-green or intensely green herb, 1—3 feet high, patently branched from the base upwards, with the habit of *Mercurialis*, *Parietaria*, or *Urtica*. Leaves  $\frac{3}{5}$ —2 inches long and  $\frac{1}{4}$ —1 inch broad, ovate-lanceolate or lanceolate, attenuate at both ends or acuminate, entire towards the base, as to the rest coarsely and irregularly crenate-serrate or rarely subentire, of the same colour on both sides, or slightly paler on the under surface, nerves on the lower surface slightly pilose; petiole half the length of the blade or shorter, puberulous or glabrate. Stipules ovate, acuminate, subscarios, pilose on the margins.

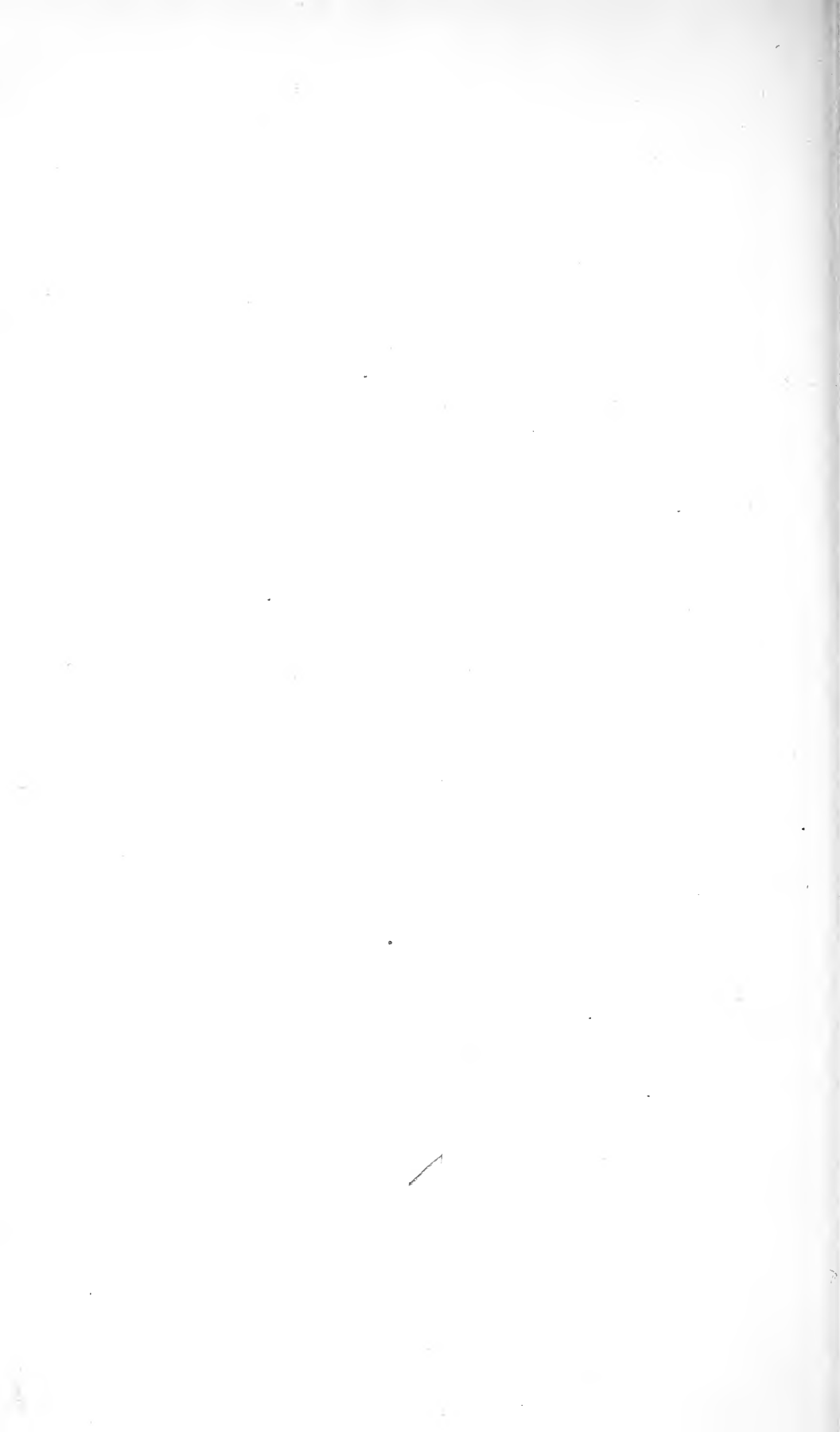
Capitula distinct, not imbricate,  $\frac{1}{5}$ — $\frac{1}{3}$  inch long, turbinate. Flowers whitish to greenish, immersed in whitish woolly hairs.

*Flowers and fruits* :—March 1878 (Perry).

*Locality* :—Goldmore Valley (Defl.); near the tanks and other places very common, in shady ravines and on volcanic rocks (Schweinf.); top of Shum Shum Range at about 1,700 feet and more, gravelly slope near the Hindoo temple at about 300 feet (Busse); without locality (Perry).

*Distribution* :—S. Arabia, Socotra, Abyssinia, Eritrea, Soturba, Mossamedes.

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## XLVIII.—HYDROCHARITACEÆ.

Fresh or salt-water herbs, with undivided submerged or floating leaves.

Flowers bisexual, monœcious or diœcious, enclosed in one or more spathes; sepals 3, green or petaloid, valvate or induplicate in bud; petals 3 or 0; stamens 3—15; anthers erect. Ovary inferior, 1-celled, or partially 3-celled by projecting parietal placentas; styles or style-arms 3—12, ovules numerous, parietal, pendulous, anatropous or orthotropous.

Fruit membranous or fleshy, often beaked; seeds few or many; endosperm 0; embryo various.

*Genera* 14; *species* about 40.

*Distribution*: Warm regions of the world.

***Halophila* Thouars.**

Submerged, perennial, marine herbs; rootstock slender, creeping, branched; leaves in pairs at the nodes of the rootstock or on short branches, with a hyaline amplexicaule sheath at the base, oval oblong or linear.

Flowers very small, monœcious, axillary, in 2-leaved hyaline spathes. Male pedicelled; sepals 3, ovate, imbricate, hyaline; stamens 3, linear, 4-celled; pollen confervoid. Female flowers sessile; sepals 3 on the apex of the beak of the ovary, most minute; petals 0; ovary ovoid, membranous, produced into a slender erect beak, slightly dilated at the apex, 1-celled, full of viscous fluid; styles 3, capillary, caducous; ovules few or many, on 3 parietal placentas, anatropous.

Fruit a beaked utricle; seeds globose, translucent; testa membranous, minutely tubercled; embryo macropodous with the spirally coiled embryo in a pit at the top.

*Species* about 10.

1. ***Halophila ovata*** Gaudich in Freyc. Voy. Bot. 430 (1826); Hook. Fl. Brit. Ind. V, 663; Trim. Fl. Ceyl. IV, 128.

*Halophila ovalis* Hook. f. Fl. Tasm. II, 45; Miq. Fl. Ind. Bat. III, 230; Boiss. Fl. Or. V, 2; Benth. Fl. Austral. VII, 182; Aschers. in Nuov. Giornal. Bot. Ital. III, 301, et in Linnaea XXXV, 173.

*Barkania punctata* Ehrh. Symb. Phys. Bot. in Abhandl. Berl. Akad. I, 429.

*Thalassia stipulacea* Thw. Enum. 332 (non Koen.)

*Caulinia ovalis* R. Br. Prodr. 339.

*Kerneria ovalis* Roem. et Schult. Syst. Veg. VII, 170.

*Description* :—Rootstock filiform, much-branched, branches often forming intricate masses, clothed with capillary root-hairs. Leaves solitary or in pairs at the nodes of the rootstock, 2—2½ inches long, from broadly oval to linear-oblong, glabrous, tip rounded or subacute, veins inter-marginal and the costae united by faint reticulating venules; petiole ¼—¾ inches long, filiform, base hardly dilated.

Spathes about ⅛-inch long. Male peduncled. Female sessile or peduncled; anthers subsessile, shortly oblong, obtuse; ovary ⅙ inch long, ovules about 12.

*Locality* :—Aden (Defl.).

*Distribution* :—Shores of Red Sea, Indian Ocean, China, Malay Islands, Pacific Islands, Australia.

*Note* :—This is a very pretty little marine plant, varying in form and more so in size. In the type the blade is oval-oblong and about 1½ inches long, but it is not seldom almost rotund and sometimes linear-strap-shaped.

#### XLIX.—SCITAMINACEÆ.

Defflers mentions the following plant as being cultivated at Shaik Othman.

*Musa paradisiaca* Linn. Sp. Pl. (1753) 1043; Trim. Fl. Ceyl. IV, 265; K. Schum. in Engl. Pflanzenr. IV, part 45 (1900) 19.

*Musa paradisiaca* var. *normalis* O. Kuntze Revis. Gen. II (1891) 692.

*Musa Cliffortiana* Linn. Sp. Pl. (1753) 1043 in syn.

*Musa sapientum* var. *paradisiaca* Baker in Ann. Bot. VII (1893) 213; Hook. Fl. Brit. Ind. VI, 262.

The well-known Banana or Plantain, called 'mooz' by the Arabs.

Native country uncertain, but probably of Asiatic origin.

Ibn el-Beithar gives some interesting notes on the medicinal properties of this plant (vol. III, 343—345).

#### L.—AMARYLLIDACEÆ.

Perennial herbs, rarely shrubs or undershrubs. Rootstock a bulb, tuber or corm, rarely an erect stock. Leaves radical. Scape naked or not.

Flowers few, often umbellate; bracts membranous or coloured, rarely herbaceous, the outer under the umbel 1—3 (rarely many-) involucre; occasionally the inflorescence racemose or paniculate with scattered bracts. Perianth regular or irregular, 2-seriate, 6-lobed or -partite, sometimes with a corona at the mouth of the tube. Stamens 5, adnate

to the bases of the perianth-segments, rarely epigynous; filaments free or connate; anthers erect or versatile. Ovary 3-celled, inferior; ovules many, anatropous, 2-seriate on the inner angles of the cells; style slender; stigma simple or 3-cleft.

Fruit inferior, usually a loculicidal capsule, rarely fleshy and bursting irregularly. Seeds few or many; albumen fleshy, enclosing the small embryo.

*Genera* 64; *species* about 650.

*Distribution*:—Temperate and tropical regions.

### **Pancratium Linn.**

Herbs with tunicate bulbs. Leaves linear or lanceolate, often bifarious.

Flowers large, umbellate or solitary, sessile or pedicellate, within one or two membranous spathes; bracteoles few, linear, hyaline. Perianth funnel-shaped; tube usually long, widened at the mouth; lobes 6, narrow, suberect, subequal. Stamens 6, shorter than the perianth, adnate to its throat; filaments filiform, but connate below in a petaloid membranous cup, the edge of which between the free filaments may be toothed or lobed; anthers oblong or shortly linear, dorsifixed. Ovary 3-celled; ovules many, 2-seriate in each cell; style long, filiform; stigma small, capitate.

Fruit a large, subglobose 3-angled, loculicidally 3-valved capsule. Seeds many, angular; testa thick, lax, black.

*Species* about 14.

*Distribution*:—Widely spread through the subtemperate and tropical regions of the Old World.

Leaves much twisted . . . . .	1. <i>P. tortuosum</i> .
Leaves not twisted . . . . .	2. <i>P. maximum</i> .

**1. *Pancratium tortuosum*** Herb. in Ann. Nat. Hist. IV (1840) 28; Kunth Enum. Pl. V, 663; Roem. Syn. Amaryll. p. 178; Anders. Journ. Linn. Soc. V, Suppl. p. 37; Baker Handb. Amaryll. p. 120; Boiss. Fl. Or. V, 153; This.-Dyer Fl. Trop. Afr. VII, 406.

*Pancratium tortifolium* Boiss. Diag. Pl. Or. ser. I, XIII, 18.

*Description*:—Bulb globose,  $1\frac{1}{2}$ —2 inches in diameter, with a long cylindrical neck. Leaves 6—12, linear, contemporary with the flowers,  $\frac{1}{2}$ —1 foot long, conspicuously spirally twisted, moderately firm, glabrous.

Peduncle very short, moderately stout. Flowers 2—4 in an umbel; pedicels very short; spathe-valve large, ovate, membranous. Perianth-tube 5—6 inches long, dilated at the apex; segments linear, ascending.

above 2 inches long. Staminal cup obconic, above an inch long, toothed between the short free tips of the filaments ; anthers linear,  $\frac{1}{4}$  inch long. Style overtopping the anthers. Capsule-valves oblong, 1 inch long.

*Flowers* :—April 1861 (Thomson).

*Locality* :—Valleys of Shum Shum Range (Anders., Deffl.) ; without locality (Birdw.).

*Distribution* :—Arabia, Nubia, Egypt.

*Note* :—Krause considers it probable that the specimen found and named as *Pancratium tortuosum* Herb. by Anderson and Defflers is identical with the following species, *P. maximum* Forsk. In favour of his opinion he mentions the fact, that the true *P. tortuosum* is almost exclusively found in sandy plains and mostly in the immediate neighbourhood of the sea, whilst rocky ravines are the favourite locality of *P. maximum*.

The author of the 'Florula' says on page 38 : " My plant, though not in flower, is doubtless the same as Herbert's species. It grows in clumps in one or two of the narrow valleys in Aden. Boissier quotes Schimper's number as 676 ; but the plant in the Hookerian herbarium is marked 876. My description is drawn partly from my own specimens and partly from the manuscript diagnosis of Herbert in the Hookerian herbarium."

We have examined Anderson's specimen and we do not doubt that his statement is correct. Thomson found the same species at Aden after the publication of the Florula, in April 1861. As to Deffler's specimen we have no reason to doubt *a priori* its correct identification.

**2. *Pancratium maximum* Forsk.** Fl. Aeg.-Arab. p. 72 ; Schweinf. in Bull. Herb. Boiss. 1894, App. II, 82 ; This.-Dyer Fl. Trop. Afr. VII, 407.

*Arabic name* :—Bassal er robach (=bulb of the baboon).

*Description* :—Bulb ovate, 2 inches long,  $1\frac{1}{5}$ — $1\frac{3}{5}$  inches broad, gradually narrowing into the neck ; teguments fuscous, outer ones thick-coriaceous, inner ones numerous, membranous ; neck elongate, consisting of the remains of the vaginas, 4—6 inches long. Caules abbreviate, 1—4, rising from the apex of the neck, consisting of the convolute bases of the leaves. Leaves 3—5 in one caulis,  $\frac{2}{3}$ — $1\frac{1}{2}$  feet long, 1 inch broad, bright-green, delicate, slightly shorter than the flowers, linear, rather abruptly acute.

Scape 1-flowered, measuring 15 inches together with the flower, much shorter than the perianth-tube. Spathe 2— $2\frac{1}{2}$  inches long, linear, binerved, 4 times shorter than the tube, bipartite in the upper third, segments linear. Pedicel extremely short ("brevissimus subnullus"). Perianth very large, almost 1 foot long, very delicate, with the odour of

' *Convallaria suaveolens* ' ; tube  $5-5\frac{3}{5}$  inches long, thin, green, slightly 6-gonous and a little widened at the apex ; limb infundibuliform, white, 5 inches in diameter at the apex ; segments  $3\frac{1}{5}-3\frac{3}{5}$  inches long,  $\frac{1}{2}\frac{7}{8}$  inch broad, spathulate, linear, very acute, in the middle of the back pale-green-lineate, expanded or more or less reflex, connate with the staminal cup for half the length of the stamens. Staminal cup campanulate ; stipular appendages narrowly triangular, separated from each other by acute sinuses, expanded,  $\frac{1}{4}$  the length of the cup. Filaments white, erect, free part  $\frac{4}{5}$  inch long ; anthers  $\frac{1}{5}$  inch long, yellow, linear. Style pale-green, slightly shorter than the filaments ; stigma capitate, trilobed.

*Flowers* :—"The plant flowered on the 6th day after a heavy shower when the leaves were fully developed on the 6th December 1888" (Schweinf.).

*Locality* :—Ravine and quarry near the Eastern Telegraph Office, plentiful between boulders at the foot of a very steep rocky slope of basaltic lava. (Schweinf.).

*Distribution* :—S. Arabia, Nubia.

### Cultivated Species :

According to Defflers the following plant is cultivated at Shaikh Othman :

*Polianthes tuberosa* Linn. Sp. Pl. ed. 1, 316 ; Bot. Mag. t. 1817 ; Trans. Hort. Soc. London I, 41, t. 2.

*Polianthes gracilis* Link Enum. Pl. Hort. Berol. Alt. I, 330.

*Polianthes mexicana* Zucc. in Abhandl. Baier. Akad. Wiss. II (1837) 319.

English name : Tuberose.

The root of this plant is a solid tuber of an irregular shape, sending forth lateral processes, upon which the buds of the future plant are formed. Grows 3—4 feet high. Leaves radical or on the lower part of the stem. Flowers white, very fragrant, in long terminal simple racemes ; perianth funnel-shaped.

Generally cultivated in America, Asia, and Europe. Believed to be endemic in Mexico.

## II.—LILIACEÆ.

Herbs, very rarely shrubs or small trees, with fibrous roots or a creeping rootstock, or a bulb or corm. Leaves various.

Flowers usually hermaphrodite, axillary or terminal, solitary, or twin, or umbellate, spicate, racemose, paniculate or fasciculate ; bracts usually small, scarious, sometimes, when the flowers are umbellate, spathe-like. Perianth herbaceous or petaloid, usually 6-merous in 2

series, imbricate, (rarely valvate,) in bud. Stamens 6, rarely 3 or fewer, hypogynous or adnate to the perianth; filaments free or connate; anthers oblong or linear, often dorsifixed, usually dehiscent longitudinally. Ovary 3-celled; ovules 2 or more from the inner angles of the cells, anatropous (rarely orthotropous); style usually simple, often long (rarely short or absent), or 3 styles.

Fruit a capsule or berry, usually 3-(rarely 1-) celled. Seeds 1 or more, globose or flattened; albumen horny or fleshy; embryo small, terete.

*Genera* 187; *species* about 2,500.

*Distribution* :—Cosmopolitan.

Flowers yellow . . . . .	1. <i>Albuca</i> .
Flowers white or violet . . . . .	2. <i>Littonia</i> .
Flowers greenish . . . . .	3. <i>Dipcadi</i> .

(This key applies only to the species described below.)

### 1. *Albuca* Linn.

Rootstock a tunicated bulb. Leaves all radical, linear or terete.

Inflorescence a cylindrical or corymbose raceme; pedicels sometimes long; bracts persistent, membranous. Flowers large, white or yellow; segments with a broad keel of green or red-brown. Perianth polyphyllous; outer segments oblong, spreading at the apex; inner connivent, cucullate at the apex. Stamens 6, hypogynous, as long as the inner segments; filaments flattened or filiform; anthers oblong, all perfect or the 3 outer abortive. Ovary oblong, 3-celled, sessile; ovules many, superposed; style triquetrous or filiform, stigma usually 3-lobed.

Capsule loculicidally 3-valved. Seeds numerous, compressed; testa membranous, black; albumen fleshy; embryo cylindrical.

*Species* : about 50.

*Distribution* :—Tropical and S. Africa, Arabia.

#### 1. *Albuca Yerburyi* Ridley in Journ. Bot. (1884), 370.

Local name : Yellow Shum Shum Lily.

*Description* :—Leaves linear, lanceolate, hispid at the base, 14 inches long, 3-4 lines broad.

Scape more than 9 inches long; raceme lax. Flowers 9 or more, yellow,  $\frac{1}{2}$  inch long, pedicellate; pedicels delicate,  $\frac{1}{4}$  inch long; bracts membranous, lanceolate, long acuminate, longer than the pedicels, scarcely  $\frac{1}{2}$  inch long. Sepals lanceolate, oblong, slightly acute. Petals subsimilar, broader, obtuse. Stamens all fertile, slightly shorter than the petals, filaments dilated at the base, complanate, above filiform. Pistil as long as the stamens; style filiform, slender; ovary ovoid,



shorter than the style ; stigmas ovate-deltoid. Capsule erect, ovate,  $\frac{1}{2}$  inch long.

*Flowers* :—March 1884 (Yerbury), Aug. 1897 (Birdw.), Nov. 1884 (Beevor).

*Locality* :—" Only found within the last 200 feet of the Shum Shum Range and there only on the ridge extending eastward from the old Arab fort " (Yerbury in epist.) ; without locality (Beevor, Birdw.).

*Note* :—" The species of this genus are widely spread over tropical and South Africa but none have been hitherto recorded from as far north as Arabia. The section to which it belongs (*Pallastema*) is typically a Tropical African one, and it seems most nearly allied to *A. abyssinica* Jacq." Ridley.

## 2. *Littonia* Hook.

Rootstock a fleshy tuber, or bulb.

Flowers solitary in the axils of many of the leaves, bright coloured. Perianth campanulate, cut down nearly or quite to the base ; segments equal, oblong-lanceolate, nectariferous and obscurely saccate at the base. Stamens 6, inserted at the base of the perianth-segments ; filaments filiform ; anthers linear-oblong, versatile. Ovary globose, sessile, 3-celled ; ovules many, superposed ; style entire in the lower part, 3-forked upwards ; stigmas minute, capitate. Capsule coriaceous, septically or loculicidally 3-valved. Seeds globose or compressed ; testa brown ; albumen firm ; embryo minute.

*Species* about 8.

*Distribution* :—Tropical and S. Africa, Arabia.

1. *Littonia minor* Defl. Bull. Soc. Bot. France XXXII, 353, fig. 354, et XLIII (1896), 232.

*Local name* :—Little Aden Lily (Yerbury).

*Description* :—A low herb, glaucescent, younger parts inconspicuously papillose-puberulous ; bulb yellow, globose, the size of a cherry ; radical fibres slightly fleshy, short ; tunica thinly membranous, forming a tubular sheath, split above and loosely surrounding the stem ; caulis erect, simple, subterranean part slender, very long, measuring 6—7 inches, aerial part green, sulcate, 3—6 inches long, leafless up to the middle, upper part provided with leaves. Leaves sessile, semi-amplexicaul, linear, long attenuate-acuminate, very acute, subacuminate at the apex, the lower ones 3-5 inches long and often in verticels of 4, the upper ones irregularly scattered, gradually getting smaller.

Flowers ebracteate, terminal, usually 2, sometimes 3—4-verticillate, erect, long-peduncled ; peduncle 8-10 lines long. Perigone campanulate,

white or violet, persistent for a long time ; segments equal, 1 inch long, 3 lines broad, free from the base, lanceolate, attenuate from the middle into a claw ; claw involute, saccate at the base, margins fimbriate, near the base 2 fuscous, nectariferous auricles. Stamens 6, hypogynous, slightly longer than the perigone ; filaments subulate, erect ; anthers attached at or slightly below the middle ; loculi laterally dehiscent. Ovary oblong, sessile. Style undivided, thin, towards the tip slightly thickened, at the apex shortly tricuspidate into the recurved stigmas, erect, exceeding the anthers.

Capsule 1 inch long,  $\frac{2}{5}$ — $\frac{1}{2}$  inch broad, surrounded by the marcescent perianth, oblong, obtuse, subclavate, 3-dymous, loculicidally dehiscent ; loculi 4—6-seeded. Seeds compressed, irregularly orbiculate,  $\frac{1}{12}$  inch in diameter ; testa fuscous-yellow, glabrous, minutely punctulate under the lens.

*Flowers* :—April 1884 (Defl.) ; Dec. 1883 (Yerbury).

*Locality* :—Little Aden, plentiful on the trachytic debris at the foot of the last spurs of Jebel Ihsan (Defl.) ; on the sand (Yerbury).

*Distribution* :—Yemen (Defl.).

*Note* :—According to Deflers the point of insertion of the anther on the filament is not constant. The anthers are usually attached at the centre of the connective, sometimes considerably below the middle, towards the lower third, and more rarely the point of insertion is situated above the middle. The length of the style, too, is very variable. It usually exceeds the stamens, but in certain flowers it scarcely reaches  $\frac{2}{3}$  of the length of the stamens. Deflers does not consider these differences as a case of normal heterostyly, but is more inclined to ascribe them to simple individual peculiarities of certain flowers.

*Littonia minor* resembles very much *L. Revoili* Franch., but the following characteristic points mark it off as a distinct species : Verticillate arrangement of the lower leaves, different colour of the flowers, complete independence of the perianth segments of each other.

Judging from the description, Krause considers it possible that *Littonia Hardeggeri* Ritter v. Beck is identical with *Littonia minor* Defl. The differences, indeed are not very great, and it seems that *L. Hardeggeri* can be distinguished only by its yellow flowers and slightly shorter stamens. (Cf. Paulitschke, Harrar Forschungsreise, page 451, Ic. figs. 8, 9).

Deflers discovered *L. minor* for the first time in 1884 on the peninsula of Little Aden. On a later visit to the same place he could not find it ; but in 1890 he came across the same species in the Hinterland of Yemen, about 60 km. west of Aden.

### 3. Dipcadi Medic.

Rootstock a tunicated bulb. Leaves all radical, usually narrowly linear.

Inflorescence a lax raceme. Flowers usually small, greenish. Perianth tubular; tube cylindric; segments 6, erect, the outer recurved from about the middle, the inner at the tips only. Stamens 6, inserted in the throat of the perianth, included; filaments short or 0; anthers linear, versatile, dehiscing introrsely. Ovary stipitate or sessile, 3-celled; ovules many in each cell; style short, straight; stigma 3-lobed.

Capsule membranous, subglobose or broadly obovate, deeply 3-sulcate, sessile or stalked, loculicidally 3-valved, few- or many-seeded. Seeds in each cell 6-20, compressed; testa black, membranous.

*Species* about 30.

*Distribution* :—S. Europe, Africa, W. Asia.

**1. Dipcadi erythraeum** Webb. et Berth. Hist. Nat. Canar. III, (1848) 341; Baker in Journ. Linn. Soc. XI, 408; Cooke Fl. Bomb. Pres. II, 770.

*Uropetalum erythraeum* Boiss. Fl. Or. V, 286.

*Hyacinthus serotinus* Forsk. Fl. Aeg.-Arab. p. 209; Del. Fl. d'Eg. p. 2.

*Dipcadi unicolor* Baker in Journ. Linn. Soc. XI (1870) 397; Hook. Fl. Brit. Ind. VI, 346.

*Description* :—Bulb tunicate,  $\frac{1}{2}$ - $\frac{7}{8}$  inch in diameter. Leaves 6-8 by  $\frac{1}{8}$ - $\frac{1}{2}$  inch, narrowly linear. Scape 4-7 inches long.

Flowers greenish, in lax 6—12-flowered racemes 4-6 inches long; bracts  $\frac{2}{3}$ - $\frac{7}{8}$  inch long, the lower the longest, ovate, finely acuminate; pedicels  $\frac{1}{6}$ - $\frac{1}{2}$  inch long. Perianth campanulate,  $\frac{2}{3}$  inch long; outer lobes  $\frac{2}{3}$  by  $\frac{1}{2}$  inch, elliptic-oblong, obtuse, with indurated tips, 7-nerved; inner lobes similar, 5-nerved. Ovary sessile,  $\frac{1}{4}$  inch long, elliptic-obovoid.

Capsule  $\frac{1}{2}$ - $\frac{3}{4}$  inch long and as broad, slightly cuneate at the base, on a stout stalk  $\frac{1}{8}$ - $\frac{1}{4}$  inch long, transversely veined. Seeds  $\frac{1}{4}$ - $\frac{5}{16}$  inch in diameter, orbicular, flat, black.

*Locality* :—Little Aden: in sandy places at the foot of Jebel Ihsan (Defl.).

*Distribution* :—Nubia, Egypt, Arabia, Sind.

### LII.—COMMELINACEÆ.

Herbs, rarely climbing or undershrubs. Leaves costate, bases sheathing, nerves parallel. Inflorescence various. Flowers usually

bisexual, more or less irregular. Perianth inferior, 6-partite; 3 outer segments herbaceous, often persistent, 3 inner petaloid, free or united in a tube below, marcescent, spreading. Stamens 6, inserted on the base of the segments, all antheriferous or 2 or more reduced to staminodes; filaments often bearded with jointed hairs; anthers oblong or globose, often dissimilar. Ovary free, 2—3-celled; style terminal; stigma small; ovules 1 or few in the inner angle of the cells, orthotropous. Capsule loculicidal or indehiscent. Seeds angled, testa smooth or rugose, albumen flowery; embryo minute, far from the hilum.

*Genera* 25; *species* about 300.

*Distribution* :—Tropical and subtropical.

### Commelina Linn.

Herbs, usually slender and creeping below.

Flowers in usually 2-fid cymes, emerging one at a time from a terminal complicate or funnel-shaped or cucullate spathe, flowers of upper branch of cyme small, deciduous, of lower fertile; fruiting pedicel and capsule retracted within the spathe. Sepals 3, membranous, 2 inner often connate at the base. Petals longer, one larger and often clawed. Stamens 3, perfect, and 2-3 imperfect; anthers oblong, one usually largest. Ovary 3-, rarely 2-celled, 2 cells 1—2-ovuled, third cell if present 1-ovuled or empty.

Capsule loculicidal, the posticous cell sometimes indehiscent or 0, or the 2 anticous cells empty connate indehiscent and forming a persistent ligulate body, from which the posticous falls away; seeds ellipsoid or angled, reticulate pitted or rugose.

*Species* about 90.

*Distribution* :—All tropical and subtropical.

1. *Commelina albescens* Hassk. in Schweinf. Beitr. Fl. Aethiop. p. 200; Clarke Monogr. 184; Hook. Fl. Brit. Ind. VI, 373.

*Commelina striata* Wall. Cat. 8981 (in part).

*Commelina Schimperiana* Hochst. in Schimp. Herb. n. 1242.

*Commelina multicaulis* Hochst. ibid. n. 2268.

*Description* :—Root-fibres thick; stems thickened at the base, often 2 or more from the root, clothed below with many white membranous sheaths, glabrous. Leaves 2-3 by  $\frac{1}{4}$ – $\frac{1}{2}$  inch, linear or linear-lanceolate, acute, glabrous, the margins often undulate. Spathes  $\frac{1}{2}$ – $\frac{3}{4}$  inch long and sometimes nearly as broad as long, 1-3 together, subsessile, glabrous or nearly so, finely striate, cucullate, falcately hooked at one end, auricled at the other.

Flowers blue, the lower raceme obsolete, the upper 3—5-flowered.

Capsules  $\frac{1}{8}$  inch long, 3-celled, 2-valved, the dorsal cell indehiscent, with muricate ribs. Seeds  $\frac{1}{10}$ — $\frac{1}{8}$  inch long, rounded at the ends and on the back, somewhat angular on the inner face, dull black.

*Locality* :—Aden (Birdw.).

*Distribution* :—Tropical Africa, Arabia, Baluchistan, Sind.

### LIII.—PALMEE.

Shrubs or trees, solitary or gregarious, naked or prickly, rarely pubescent. Stem erect, scandent or decumbent, rarely branched above. Leaves alternate, plaited in bud, pinnatisect or palmate, rarely simple or bipinnate; petiole sheathing.

Flowers 1—2-sexual, small, in panicles or spikes that are enclosed in one or more large sheathing bracts (spathes), usually 3-bracteate. Perianth inferior, segments 6 in two series (sepals and petals), usually all free, imbricate or valvate. Stamens 3 or 6, rarely more; anthers versatile. Ovary 1—3-celled or of 3 1-celled carpels; stigmas 3, usually sessile; ovules 1-2 in each carpel, adnate to the wall, base, or top of the cell, anatropous.

Fruit a 1—3-celled drupe or hard berry or of 1-3 carpels; pericarp smooth, rough or clothed with shining scales that imbricate downwards. Seeds erect or laterally attached, rarely pendulous; raphe usually branching all over the testa; albumen horny or bony, solid or ruminant; embryo small, in a small cavity near the surface of the albumen.

*Genera* about 180; *species* about 1,300.

*Distribution* :—Chiefly tropical.

Leaves fan-shaped . . . . .	1. Hyphaene.
Leaves pinnate . . . . . (cultivated)	2. Phoenix.

#### 1. Hyphaene Gaertner:

Unarmed except for the spines on the petioles. Stem cylindrical or ventricose, simple or dichotomously branched. Leaves in a terminal crown, orbicular or flabellate; segments ensiform; petiole concavo-convex, plano-convex, or more rarely bi-convex; sheath short, open; ligule oblique or equilateral.

Spathes cylindrical, incomplete; spadices dioecious, male and female similar; spadix branches alternate; flower-bearing branches subfastigiate; bracts semicircular, very densely imbricate; bracteoles membranous, bearded. Male flowers: Sepals linear-oblong, imbricate, connate at the base. Petals broadly ovate, obtuse, concave, imbricate, connate at the base into a short stalk. Stamens 6; filaments short, subulate; anthers

linear, inserted at the bifid base. Rudiment of ovary 0. Female flowers larger than the male, very shortly pedicellate. Sepals 3, ovate-orbicular, obtuse, imbricate. Petals a little smaller than the sepals, broadly ovate, obtuse, imbricate. Staminodes 3, connate into a membranous ring. Ovary subglobose, obscurely 3-lobed, 3-celled; stigmas 3, minute, sessile, terminal, at length excentric; ovule attached by a broad base to the side of the cell.

Fruit sessile or stalked, terete or obscurely lobed, often flat or intruded at the base and apex, 1-celled; stigma basal; pericarp fibrous, with a shining epidermis; endocarp woody, fleshy inside. Seed adnate to the endocarp, erect, ovoid or obovoid, intruded at the base; testa very hard, fuscous; raphe reticulately branched; albumen homogeneous, hollow; embryo apical.

*Species* at least 40.

*Distribution*:—All over tropical and subtropical Africa, Arabia, Western India.

1. *Hyphaene thebaica* Mart. Hist. Nat. Palm. III, 226 (ed. 1), excl. syn. nonnullis, tab. 131, 132, 133 (excl. ic. spadix masculae in tab. 132); Becc. in Agricolt. Colon. (1908) II, fasc. III.

*Corypha thebaica* Linn. Sp. Pl. ed. 2 (1763) 1657.

*Cucifera thebaica* Delile Descr. de l'Egypt II, 57, t. 1, 2; Dict. Hist. Nat. XIII, 472.

*Douma thebaica* Poir. Encycl. Suppl. II, 519.

*Hyphaene cucifera*, Pers. Ench. II, 2245.

*Chamaeriphes thebaica* Kuntze Rev. Gen. Pl. II (1891) 728.

*Names*:—Egyptian Doum Palm; Gingerbread Tree; Mama (in Egypt).

*Description*:—Stem terete, 10-30 feet high, about 1 foot in diameter, simple or more frequently dichotomously branched. Leaves 20-30 in a terminal crown on each branch; petiole sheathing at the base, triangular below, plano-convex upwards, spiny on the margins, with rusty tomentum; lamina suborbicular, lobes 20 or more, linear-lanceolate, acuminate,  $1\frac{1}{2}$  feet long, 1 inch wide; primary nerves thick, concave above, secondary numerous.

Male spadix about 4 feet long, 1-2 inches thick at the base, at first erect, afterwards patent; spathes nearly cylindrical; flower-bearing branches 6-7 inches long, 3-2 at the end of branches 3-4 inches long; bracteoles  $\frac{1}{2}$  line long. Flowers in pairs, shortly pedicellate. Calyx divided down to the base into 3 narrow acute yellow sepals, contracted below. Corolla stipitate with the segments imbricate, rotundate and cucullate at the apex, thin and not strongly striate-nervose. Stamens 6,

rarely 7 ; filaments subulate from a thickened base ; anthers linear, slightly sagittate, nearly basifixed.—Female spadix like the male ; bracteoles densely imbricate, with a transverse line of tomentum halfway up the back. Flowers very shortly pedicellate. Calyx-lobes orbicular-ovate, light green. Petals smaller than the sepals, orbicular-ovate, concave. Stamines 6. Ovary globose or 3-lobed ; stigmas sessile or nearly so.

Fruit more or less obliquely ovoid or oblong, irregular, usually a little more constricted in the upper part than in the middle and lower part, always much longer than broad,  $2\frac{4}{5}$ – $3\frac{1}{5}$  inches long and  $2\frac{1}{5}$ – $2\frac{2}{5}$  inches broad, more or less obtusely triangular in transverse section, with the abortive carpels often much developed ; surface rather irregular and usually very distinctly punctate-impressed. Sarcocarp rather strongly impregnated with sugar ; wall of endocarp  $\frac{1}{12}$ – $\frac{1}{8}$  inch thick on one side, on the other (which corresponds to an obtuse longitudinal keel)  $\frac{1}{8}$ – $\frac{1}{5}$  inch, not thicker below than on the sides and not incurved at the apex of the seed. Seed more or less ovate-conical, and flattened at the base, more or less pyriform,  $1\frac{2}{5}$ – $1\frac{3}{5}$  inches long,  $1\frac{1}{12}$ – $1\frac{1}{8}$  inches broad.

*Locality* :—Shaikh Othman (Defl.).

*Distribution* :—Along the Nile-valley in Middle and Upper Egypt.

*Uses* :—The leaves of younger plants are eaten by camels. The old leaves are put to many minor uses. The trunk is used for making water conduits, and it is possible that it might contain a little sago in just the same measure as the common Indian fan palm, enough to make it a famine food. The thick fleshy-fibrous part of the fruit resembles gingerbread both in colour and taste, hence the palm is often known as the Gingerbread tree. The chief use of the palm is for the manufacture of buttons from the hard inner fruit-wall. It is also turned into beads for rosaries.

The following species, probably introduced has been observed by Deffers at Shaikh Othman. We have seen a few specimens cultivated in the town of Aden.

**Phoenix dactylifera** Linn. Hort. Cliff. 482 ; Spec. Pl. ed. Willd. IV, 730. The Date Palm.

*Description* :—A tall tree ; trunk covered with the persistent bases of the petioles, the foot often surrounded by a dense mass of root suckers. Leaves grey, pinnae 8–16 inches long, regularly distichous, forming a very acute angle with the petiole, often approximate in twos or threes on the same side of the petiole ; petiole grey, laterally compressed, almost flat.

Male panicles white, compact, 6-9 inches long, on a short peduncle, flowers  $\frac{1}{4}$ - $\frac{1}{2}$  inch long, sweet scented; sheaths outside with rusty down. Peduncles of female inflorescence  $\frac{1}{3}$ - $\frac{1}{2}$  inch broad, sometimes broader below; spikes 12-24 inches long.

Fruit oblong, 1-3 inches long, pulp fleshy sweet. Seed cylindric, with a longitudinal furrow in front and a small cylindric embryo in the middle of the rounded back.

Believed to be indigenous in the Euphrates and Tigris Doab, and in the oases of the great African Sahara.

#### LIV.—NAIADACEÆ.

Aquatic or marsh herbs of various habit; rootstock stout or slender, sometimes tuberous, often creeping or 0; stem floating or rooted in the ground. Leaves entire or serrate, submerged or floating, sheathing at the base, sometimes stipulate.

Flowers uni- or bi-sexual, green, usually inconspicuous, in spikes, racemes, or terminal or axillary pedunculate spadices; bracts small or 0. Perianth 0, or of 3-4 inferior valvate segments, or tubular and very delicate. Stamens 1-6, hypogynous, free in bisexual flowers, solitary or connate in male flowers; anthers 1-2-celled. Carpels 1-6; ovules 1 or more in each carpel, erect or pendulous; style long or short, stigma usually simple, sometimes stigmas 2-3, capillary.

Fruit various. Seeds erect, pendulous, or laterally peltate, testa coriaceous or somewhat fleshy; albumen 0; embryo fleshy, straight.

*Genera* 16; *species* about 150.

*Distribution*:—In all climates.

##### 1. *Cymodocea* Kœnig.

Submerged marine plants, with rigid jointed and creeping rootstocks. Leaves oblong or linear, with stipular sheaths.

Flowers axillary, unisexual or bisexual, in membranous sheaths. Perianth 0. Male flowers: Anthers 2, long, connate, stipitate, extrorse. Female flowers: Carpels 2, subsessile, ovoid, compressed, 1-ovuled; style short; stigmas subulate; ovule pendulous, orthotropous.

Fruit of 2 ovoid carpels. Seeds pendulous; testa thick; embryo inflexed.

*Species* 7.

*Distribution*:—Shores of the Indian and Pacific Oceans.

Leaves not terete:—

Leaves falcate	.	.	.	.	.	.	.	7	1. <i>C. ciliata</i> .
Leaves straight	.	.	.	.	.	.	.	.	2. <i>C. serrulata</i> .
Leaves terete	.	.	.	.	.	.	.	.	3. <i>C. isoëtifolia</i> .



**1. Cymodocea ciliata** (Forsk.) Ehrbg. ex Aschers. in Sitzungsber. Ges. Naturf. Fr. Berl. (1867), p. 3 ; Linnaea XXXV, 162 ; Schweinf. Beitr. Fl. Aethiop. p. 242 ; Boiss. Fl. Or. V, 23 ; Benth. Fl. Austral. VII, 178 ; Aschers. in Sitzungsber. Bot. Ver. Brandb. (1882) p. 28 ; Hook. Fl. Brit. Ind. VI, 570 ; Bennet. in This.-Dyer. Fl. Trop. Afr. VIII, 229.

*Thalassia ciliata* Kön. Ann. Bot. II, 97 ; Kunth Enum. Pl. III, 120.

*Posidonia serrulata* Thw. Enum. 333 (non Aschers. !)

*Zostera ciliata* Forsk. Fl. Aeg.-Arab. p. 157.

*Phucagrostis ciliata* Ehrbg. et Hempr. Symb. phys. bot. t. VI ined. ex Aschers. l.c.

*Arabic Name* : Suram.

*Description* :—A robust plant ; stem 3—12 inches long, woody ; branches quasi-woody, erect, arising from short internodes, the scars of the leaves forming closed rings. Leaves 3—6 inches by  $\frac{1}{4}$ — $\frac{3}{8}$  inch, linear-falcate, 23—25-nerved, emarginate-retuse at the apex, tip ciliate-serrulate ; sheath 1 inch long, up to  $\frac{2}{3}$  inch broad, obconical, only 2—3-times longer than broad, with small auricles.

Male flowers and fruits not known.

*Locality* :—South-western shore of Khor Bir Achmed and at Khor Maksar at a depth of from 5—10 feet (Defl.) ; without locality (Thomson, Sept. 1872).

*Distribution* :—Coasts of the Indian and Pacific Oceans.

**2. Cymodocea serrulata.** (R. Br.) Aschers. et Magn. in Sitzungsber. Ges. Naturf. Fr. Berl. (1870) p. 84 ; Boiss. Fl. Or. V, p. 22 ; Hook Fl. Brit. Ind. VI, 570 ; Bennet in This.-Dyer Fl. Trop. Afr. VIII, 229.

*Posidonia serrulata* Spreng. Syst. I, 181.

*Caulinia serrulata* R. Br. Prodr. Fl. Nov. Holl. (1810), 339.

*Kernera serrulata* Schult. Syst. Veg. VII (1829) 1702 ?

*Thalassia indica* Wight et Arn. in Wight Herb. n. 2414 ex Aschers, in Boiss. Fl. Or. V (1884) 22.

*Thalassia reptans* Solander mss. in Herb. Mus. Brit.

*Description* :—Stems long, creeping, the scars of the leaves forming open rings. Leaves 4-6 inches by  $\frac{1}{8}$ — $\frac{1}{4}$  inch, linear, nearly straight, 11—19-nerved, tip entire or denticulate ; sheath obconical, 2-3 times as long as broad, distinctly auricled.

Male flowers and fruits not known as yet.

*Locality* :—South-western shore of Khor Bir Achmed at a depth of 5-10 feet (Defl.).

*Distribution* :—Coasts of the Indian and Pacific Oceans.

3. *Cymodocea isoëtifolia*. Aschers. in Sitzungsber. Ges. Naturf. Fr. Berl. (1867) p. 3; Linnaea XXXV, 163; Nuovo Giorn. Bot. II, 182; Boiss. Fl. Or. V, 22; Benth. Fl. Austral. VII, 178; Hook. Fl. Brit. Ind. VI, 570.

*Cymodocea æquorea* Kunth Enum. Pl. III, 118 (excl. syn.); Thw. Enum. p. 333.

*Description* :—Rhizome slender, short, red, the leaf-scares forming open rings. Leaves terete, grooved, 3-5 inches long,  $\frac{1}{12}$ - $\frac{1}{10}$  inch broad, bright green, pale glaucescent when dry, longitudinally sulcate, retuse at the apex; sheath cylindrical-obconical, up to  $1\frac{3}{8}$  inches long, in the upper part  $\frac{1}{8}$ - $\frac{1}{6}$ -inch broad.

Flowering branch in the lower part laxly distichously branched. Inflorescence cymose, multiflowered, finally passing into spiciform cymes. Flowers involucrate with 2 bracts, which are as long as the sheath. Anthers  $\frac{1}{2}$  inch long.

Fruit  $\frac{1}{8}$  inch long.

*Locality* :—South-eastern shore of Aden, February 1890 (Defl.).

*Distribution* :—Indian and Pacific Oceans.

#### LV.—CYPERACEÆ.

Perennial, rarely annual herbs with the habit of grasses; roots fibrous; stem terete or 3-angled, usually simple. Leaves grass-like, rarely 0, 3-ranked, mostly crowded at the base of the stem (the upper fewer), with tubular sheaths which are more or less closed or the lower split to the base; ligule 0 or a short prolongation of the mouth of the sheath opposite to the blade.

Inflorescence of solitary, fasciculate, paniculate or spicate spikelets, composed of small distichously or spirally imbricate scales (glumes); flowers minute, 1-2-sexual, in the axils of the glumes. Perianth 0, or of 2 or more hypogynous bristles or scales (ovary enclosed in a utricle in *Carex*). Stamens 1-3; filaments flattened; anthers basifixed, linear. Ovary 1-celled; ovule solitary, basal, erect, anatropous; style short or long; stigmas 2-3.

Fruit a compressed or trigonous nut. Seed erect, free; embryo minute, within the base of the floury albumen.

*Genera* about 65 ; *species* about 3,000.

*Distribution* :—All over the world.

### **Cyperus Linn.**

Perennial, rarely annual, glabrous herbs ; rhizome creeping, short or long or 0. Leaves mostly towards the base of the stem, occasionally reduced to sheaths.

Spikelets in solitary globose or umbellate heads or spikes ; involu-  
cral bracts 1 or more, foliaceous ; bracteoles under the secondary  
divisions of the inflorescence ; rachilla usually persistent, not, for in a  
few species disarticulating towards the base, sometimes with mem-  
branous wings derived from the persistent glume-bases. Glumes  
distichous, the 2 lowest empty, those above 2-sexual, all nearly equal,  
deciduous from below upwards, the uppermost 1-3 sterile or empty ;  
hypogynous scales or bristles 0. Stamens 1-3 ; anthers linear or  
oblong. Ovary compressed, style short or long or obsolete ; stigmas  
2 or 3.

Fruit trigonous, triquetrous, obovoid, or plano-convex.

*Species* about 360.

*Distribution* :—All warm and temperate regions.

- |   |                              |
|---|------------------------------|
| Glumes not very approximate ; spikelets 8-16-flowered . . .           | 1. <i>C. conglomeratus</i> . |
| Glumes very approximate ; spikelets often 20-40-flowered :            |                              |
| Stem rather thick, terete, striate, at the top hardly trigonous . . . | 2. <i>C. effusus</i> .       |
| Stem rather slender, at the top more or less trigonous . . .          | 3. <i>C. cruentus</i> .      |

**1. *Cyperus conglomeratus* Rottb.** Descr. et Ic. Pl. p. 21, tab. 15,  
fig. 7 ; Dene. Ann. Sc. Nat. (1834), p. 15 ; Steud. Syn. Pl. Glum. II,  
15 ; Boiss. Fl. Or. V, 369 (var.  $\alpha$  in great part) ; Aschers. et  
Schweinf. Ill. Fl. d'Eg. p. 156 ; Hook. Fl. Brit. Ind. VI, 602 ; Clarke  
in This.-Dyer Fl. Trop. Afr. VIII, 324.

*Cyperus pungens* Boeck. Linnaea XXXV, 537 (except part of  $\alpha$   
*elata*) ; Clarke in Journ. Linn. Soc. XXI, 113.

*Cyperus proteinolepis* var. *pumila* Boeck. Linnaea XXXV, 542.

*Cyperus Jemicus* Rottb. Descr. et Ic. Pl. p. 25, tab. 8, fig. 7 ;  
Kunth Enum. Pl. II, 24 (not of Retz.).

*Cyperus arcuatus* Boeck. in Linnaea XXXV, 542.

*Description* :—Glabrous, glaucous-green ; rhizome usually hardly  
any, sometimes elongate,  $\frac{1}{8}$ - $\frac{1}{6}$  inch in diameter ; roots of stout woolly  
fibres ; stems stout, 4-24 inches long, terete below, trigonous above  
thickened at the base, clothed with brown ovate acuminate scales.  
Leaves sometimes twice as long as the stem, sometimes only half as

long,  $\frac{1}{10}$ – $\frac{1}{8}$  inch broad, very stout and tough, midrib very obscure, margins much inrolled when dry.

Umbel simple, often contracted into one head, 1–1½ inches in diameter, of densely crowded spreading spikelets; bracts 3–5, lowest suberect, dilated at the base, often 3–6 inches long, similar to the leaves. Spikelets  $\frac{1}{2}$ –1 by  $\frac{1}{8}$ – $\frac{1}{6}$  inch, oblong-lanceolate, compressed, 10–24-flowered; rhachilla stout, scarred, not winged. Glumes reaching  $\frac{1}{2}$  by  $\frac{1}{16}$  inch, oblong-lanceolate, cymbiform, with a short stout mucro extending beyond the rounded tip, with many reddish-brown nerves and hyaline margins. Stamens 3; filaments  $\frac{1}{10}$  inch long, ligulate; anthers yellow,  $\frac{1}{8}$  inch long, narrowly linear, mucous. Style short; branches 3, linear, rather long.

Nut as long as  $\frac{1}{2}$  the glume, obovoid, unequally trigonous.

*Flowers*:—January 1872 (Thomson), February 1851 (Thomson), March 1878 (Perry), Nov. 1888 (Schweinf.), Dec. 1888 (Schweinf.), Dec. 1889 (Defl.).

*Locality*:—Near the seashore (Balfour); plain of Maala (Defl.); Goldmore Valley (Defl., Schweinf.); above the coal depôt of the Messag. Marit. (Schweinf.); great valley between Steamer-Point and town (Marchesetti); without locality (Birdw., Perry, Thomson).

*Distribution*:—Senegambia, Togo, Egypt, Nubia, Abyssinia, Eritrea, Central and S. Arabia, S. Persia, Sind, Gujarat, Western India, Laccadive Islands, Ceylon.

2. *Cyperus effusus* Rottb. Descr. et Ic. Pl. p. 22, tab. 12, fig. 3; Kunth Enum. Pl. II, 47; Steud. Syn. Pl. Glum. II, 29; Edgew. Journ. As. Soc. Beng. XVI, 1220; Boeck. in Linnæa XXXV, 543; Clarke Journ. Linn. Soc. XXI, 112; Clarke in This.-Dyer. Fl. Trop. Afr. VIII, 325; Hook. Fl. Brit. Ind. VI, 603.

*Cyperus proteinolepis* Steud. Syn. Pl. Glum. II, 15; Boeck. in Linnæa XXXV, 522; Clarke in Journ. Linn. Soc. XXI, 113.

*Cyperus conglomeratus* var. *effusa* Boiss. Fl. Or. V, 369.

*Cyperus conglomeratus* var. *major* Boeck. in Linnæa XXXV, 544 (partim); Clarke in Journ. Linn. Soc. XXI, 112.

*Cyperus curvulus* Boeck. in Linnæa XXXV, 541 (partim).

*Cyperus densus* R. Br. in Salt Abyss. Append. p. 63 (nomen tantum).

*Cyperus involutus* R. Br. l. c. (nomen tantum).

*Description*:—The stem is rather stouter than in *C. cruentus* (*vide infra*) striate, terete, hardly at all trigonous even at the top.

Spikelets nearly as those of *C. cruentus*, i.e., narrower with less

distant glumes than the spikelets of *C. conglomeratus* ; otherwise as the two species here described.

"The spikelets in this species are usually 20-40-flowered (the glumes standing much closer than in *C. conglomeratus*), and sometimes they are (though narrow) more than  $1\frac{1}{2}$  inches long with 60 flowers. It should be understood that this series (*C. conglomeratus*, *cruentus*, *effusus*) are considered but one species by Boissier and by Cosson (botanists who generally took a narrow view of species) ; while Boeckeler has described them as 6 or 7 species. The variability of the series is great, and a middle course has been taken here of collecting the forms under the 3 old types of Rottboell. But as Boeckeler has grounded his species largely on the size of the specimens, the curvature of the stems etc., (esteemed as of small import here), the synonymy has become both complex and imperfect." (Clarke in This.-Dyer Fl. Trop. Afr. VIII, 326).

*Locality* :—Gravelly slopes of the Shum Shum Range (Hildebrandt, Ellenbeck); without locality (Edgew., Birdw.).

*Distribution* :—Upper Egypt, Abyssinia, Eritrea, Syria, Central and S. Arabia, Socotia.

3. *Cyperus cruentus* Rottb. Deser. et Ic. 21, t. 5, fig. 1, 4; Kunth Enum. II, 82; Clarke in Durand and Schinz Conspect. Fl. Afr. V, 555, and in This.-Dyer Fl. Trop. Afr. VIII, 325.

*Cyperus falcatus* Nees et Ehrbg. ex Boeck, in Linnæa XXXV, 546, et in Flora (1879) p. 550; Schweinf. Beitr. Fl. Aethiop. 215, et in Bull. Herb. Boiss. II, Append. II, 47; Zarb Cat. Spéc. Bot. Pfund, 39.

*Cyperus proteinolepis* Steud. Syn. Pl. Glum. II, 15 (partim); Boeck. in Linnæa XXXV, 522 (partim, at least Kotschy, n. 27, cited).

*Cyperus curvulus* Boeck. in Linnæa XXXV, 541 (partim).

*Cyperus conglomeratus* T. Anders. in Journ. Linn. Soc. V, Suppl. p. 38; Clarke in Journ. Linn. Soc. XXI, 112 var.  $\alpha$ ; Schweinf. in Bull. Herb. Boiss. II, Append. II, 47.

*Cyperus pungens* Boeck. in Linnæa XXXV, 538.

*Description* :—Stems at the top trigonous. Spikelets narrower and glumes less distant on the rhachilla, but otherwise as *C. conglomeratus*.

*Flowers and fruits* in March and April (Schweinf.).

*Locality* :—Near the seashore (Hook., Ander.). Goldmore Valley (Lunt); above the coal-depôt of the Messag. Marit. (Schweinf.); without locality (Birdw.).

*Distribution* :—Upper Egypt, Nubia, Eritrea, Arabia, Baluchistan.

LVI.—GRAMINEÆ.<sup>1</sup>

Erect decumbent or creeping herbs, rarely suffruticose, or shrubs or trees (*Bambuseæ*) ; stems usually branched at the base, terete or compressed, with hollow or solid internodes. Leaves distichous, simple, usually long and narrow, generally parallel-nerved, with a sheathing base (sheath) distinct from the blade and rarely an interposed petiole ; sheath split to the base, very rarely entire, with usually a transverse erect appendage (ligule) consisting of a membrane or a fringe of hairs at the union with the blade.

Inflorescence terminal (rarely terminal and lateral), composed of variously arranged spikelets, paniculate, racemose, capitate, simply or compoundly spicate, rarely of a single spikelet. Spikelets consisting of an axis (rachilla) and typically of 3 or more alternate, distichous, more or less heteromorphous bracts (glumes), of which the two lowest (involucral glumes) form an involucre to the spikelet and are empty, while the following (floral glumes) bear in their axils subsessile flowers subtended by a hyaline 2-keeled or 2-nerved dorsal scale (palea) ; floral glumes differing usually in structure and size from the involucral glumes, and forming with the palea and the flower proper false flowers (florets), which are alike or different in structure and sex. Flowers hermaphrodite or 1-sexual (often with the rudiments of the other sex), consisting of 2, rarely 3, minute hyaline fleshy scales (lodicules) which represent a perianth (sometimes absent), and of stamens or a pistil or both. Stamens usually 3, rarely 6, 4, 2, or 1, very rarely more, hypogynous ; filaments slender, usually free ; anthers versatile, fugacious, with 2 parallel cells, usually dehiscent by a longitudinal slit. Ovary entire, 1-celled ; ovule erect, anatropous ; styles 2 (rarely 3 or 1,) free or connate at the base, usually elongate and exserted from the apex or sides of the spikelet, clothed with simple or branched stigmatic hairs.

Fruit a seed-like grain, free within the flowering glume and palea or adnate to either or both ; pericarp very thin, rarely thick and separable from the seed. Seed erect, albumen copious, floury ; embryo minute, at the base of and outside the albumen ; cotyledon shield-shaped with an erect conical plumule and a descending conical radicle.

*Genera* about 325 ; *species* between 3,000 and 3,500.

*Distribution* :—All over the world.

**Series I.**<sup>2</sup> Mature spikelets falling entire from their pedicels or with them, all alike or differing in sex and structure ; perfect spikelets

<sup>1</sup> We follow in the main O. Stapf's publications on this order.

<sup>2</sup> In arranging this key we followed in the main lines Dr. Stapf in the "Flora capensis" (1898).

with 2 heteromorphous florets, the upper hermaphrodite, the lower male or barren ; rhachilla not continued beyond the upper floret.

**Tribe 1. Andropogoneae.** Spikelets usually in pairs, one sessile, the other pedicelled, rarely 3-nate or solitary on the axes of variously arranged, often spikelike, racemes. Glumes more or less rigid and firmer than the valves, and the lower always longer than the florets. Valves membranous, often hyaline, that of the upper floret generally awned or reduced to an awn . . . . .

1. Andropogon.

**Tribe 2. Paniceae.** Spikelets in usually continuous spikes, racemes or panicles. Glumes herbaceous, or membranous, the lower smaller, very small or suppressed. Lower valve generally resembling the glumes in structure and nervation, the upper firmer, at length rigid, often chartaceous to crustaceous, awnless, very rarely mucronate.

**A.** Mature spikelets persistent on their pedicels, surrounded singly or in clusters by an involucl of naked or plumose bristles or spines which fall along with the spikelets . . . . .

2. Pennisetum.

**B.** Mature spikelets falling entire and singly from the tips of their pedicels :

Spikelets subtended by an involucl of bristles . . . . .

3. Setaria.

Spikelets not subtended by bristles :

Fruiting valve rigidly membranous . . . . .

4. Tricholæna.

Fruiting valve subchartaceous to crustaceous :

Lower involuclal glume distinct . . . . .

5. Panicum.

Lower involuclal glume absent or minute :

Spikelets not thickened at the base . . . . .

6. Digitaria.

Spikelets thickened at the base . . . . .

7. Eriochloa.

**Series II.** Mature spikelets breaking up, leaving the persistent or subpersistent glumes on the pedicel, or if falling entire, then not consisting of 2 heteromorphous florets as in Series I.

**Tribe 3. Stipeae.** Floret 1. Rhachilla not produced beyond the upper floral glume which is bisexual, hardened when mature, tightly enveloping the fruit. Nerves joining or closely approaching at the tip . . . . .

8. Arristida.

**Tribe 4. Sporoboleae.** Involuclal and floral glumes very similar. Floret 1. Rhachilla not (or rarely) produced beyond the floret. Upper floral glume membranous, acute or obtuse, not changed when ripe, 1-or more or less 3-nerved, awnless, usually olive-green or grey ; side-nerves, if present, delicate, evanescent above . . . . .

9. Sporobolus.

**Tribe 5. Eragrostæ.** Spikelets variously paniced, sometimes spicate or subspicate. Florets usually numerous and far exserted from the glumes. Involucral and floral glumes somewhat similar in general appearance. Floral glumes membranous or chartaceous, entire or 2-3-cleft, 3-nerved, the nerve evanescent above or excurrent into bristles; side-nerves usually submarginal, glabrous or pubescent or finely ciliate below. Paleæ often persistent or subpersistent.

Upper involucral glume 3-nerved :

Spikelets usually paniced, rarely in simple spikes.

Rhachilla often persistent. Valves usually numerous and closely imbricate, broad, entire, awnless .

10. *Eragrostis*.

Spikelets crowded on and falling entire from the flattened axis of stiff spreading secund spikes, which are closely arranged on a long common axis . . . .

11. *Desmostachya*.

Upper involucral glume 5-nerved . . . .

12. *Halopyrum*.

**Tribe 6. Chloridæ.** Spikelets usually in 2-ranked secund spikes or spike-like racemes, rarely distinctly pedicellate and paniculate. Florets 1 to many. Floral glumes usually membranous, truncate, emarginate or toothed, 3-nerved; nerves distant, subparallel, distinct, percurrent or excurrent, and often ciliate all along, the lateral submarginal (in *Eleusine* there are sometimes additional side-nerves close to the middle nerve of the glume). Awn, if present, straight, usually from a truncate or toothed tip.

Floret 1, awnless . . . . .

13. *Cynodon*.

Florets several, one hermaphrodite, the others male or barren . . . . .

14. *Chloris*.

Several to many hermaphrodite florets in each spikelet .

15. *Eleusine*.

**Tribe 7. Pappophoræ.** Floral glumes broad, 5-many-nerved, cleft into 3-many subulate lobes with or without alternating fine straight awns from the sinuses.

Floral glumes 9-cleft . . . . .

16. *Enneapogon*.

**Tribe 8. Festuceæ.** Involucral glumes more or less resembling the floral ones in general appearance. Fruiting florets 2 to many (very rarely 1), often much exserted from the glumes. Floral glumes 5-or more-nerved, rarely 1—3-nerved. Awns, if present, terminal subterminal, never geniculate.

Leaves narrow, less than 2 inches long, rigid, pungent .

17. *Aeluropus*.



1. *Andropogon* Linn.

Perennial or annual grasses of very varied habit. Leaves usually narrow. Spikelets similar or heteromorphous, 2-nate (one sessile, the other pedicellate), on the fragile rhachis of solitary, 2-nate, digitate fasciculate or paniculate racemes. Pedicellate spikelets usually smaller than the sessile. Sessile spikelets 1-flowered; callus long or short. Glumes 3 or 4; lower involucreal glume coriaceous or chartaceous, 2-keeled, muticous; upper involucreal glume usually thinner, with a median keel, rarely awned; lower floral glume hyaline or 0, neuter; upper floral glume hyaline, usually awned, often reduced to the dilated base of the awn, 2-sexual; palea various or 0. Lodicules 2, cuneate. Stamens 3-1. Stigmas laterally exserted. Grain various.

*Species* more than 200.

*Distribution* :—Warm parts of the world.

Flowers in solitary racemes . . . . . 1. *A. foveolatus*.

Flowers in panicles:

Leaves junciform . . . . . 2. *A. Iwarancusa*.

Leaves linear-lanceolate or linear . . . . . 3. *A. sorghum*.

**1. *Andropogon foveolatus*** Del. Descript. de l'Egypte (1812), p. 160; Kunth Enum. Pl. I, 490; Steud. Syn. Pl. Glum. I, 366; Boiss. Fl. Or. V, 462; Hook. Fl. Brit. Ind. VII, 168; Hack. in DC. Monogr. Phan. VI, 402; Prain Beng. Pl. p. 1201; Cooke Fl. Bomb. Pres. II, 977.

*Andropogon strictus* Roxb. Fl. Ind. I, 260.

*Andropogon orthos* R. et Schult. Mant. II, 455.

*Andropogon monostachyus* Spreng. Pugill. Pl. Nov. II, 9.

*Description* :—Stems 1-2 feet long, densely tufted, usually decumbent at the base, then geniculately ascending, very slender, glabrous; nodes bearded. Leaves 3-6 by  $\frac{1}{20}$ – $\frac{1}{10}$  inch, linear, puberulous beneath; sheaths shorter than the internodes, scabrous or glabrous, the basal sheaths silky-villous; ligule short, truncate, hyaline, ciliate.

Racemes 1-1½ inches long, solitary; peduncles capillary, erect, usually far exserted beyond the slender spathe; joints and pedicels

slender, ciliate on 2 opposite sides with long silky hairs, shorter than the sessile spikelets. Spikelets  $\frac{1}{6}$  inch long (the sessile and pedicellate equal), oblong lanceolate, glabrous, purplish; callus small, shortly hairy at the base; lower involucral glume  $\frac{1}{6}$  inch long, flat, lanceolate-oblong, subobtuse, with narrowly involute margins, 4-nerved, usually marked with a deep pit above the middle; upper involucral glume equal to the lower, lanceolate, acute, obscurely 3-nerved; lower floral glume much shorter, oblong-lanceolate, glabrous, nerveless; upper floral glume reduced to an awn  $\frac{1}{2}$ – $\frac{2}{3}$  inch long, the column about equalling the subulate portion. Anthers  $\frac{1}{10}$  inch long. Pedicellate spikelets: Pedicels  $\frac{1}{10}$  inch long. Glumes 2; lower involucral-glume  $\frac{1}{6}$  inch long, lanceolate, acute, with slightly incurved margins, the keels above aculeately scabrid, 5-nerved, pitted or not; upper involucral glume equalling the lower, linear-lanceolate, acute, 3-nerved.

*Fruits*:—March (Schweinf.).

*Locality*:—Dry gravelly plains of Goldmore Valley, ravine above the European cemetery of Steamer Point, above the coal-depôts of the Messag. Marit. (Schweinf.), sandy plains of Maala (Defl.), slope of Shum Shum Range (Ellenbeck).

*Distribution*:—Canaries, Cape Verd Islands, Egypt, Abyssinia, Eritrea, Arabia, S. Persia, Sind, Deccan, throughout the drier parts of India.

**2. *Andropogon Iwaraneusa*** Jones in Asiat. Research. IV (1795) 109. var. *laniger* Hook. Fl. Brit. Ind. VII, 203; Cooke Fl. Bomb. Pres. II, 976.

*Andropogon laniger* Desf. Fl. Atlant. II, 379; Kunth Enum. Pl. I, 493; Steud. Syn. Gram. 386; Hack. Monogr. Androp. 598; Aitchis. Cat. Panj. Pl. 174; Duthie Grass. N. W. Ind. 20, Fodd. Grass. N. Ind. 35, t. 23; Lisboa in Bom. Journ. Nat. Hist. Soc. VI (1891); Boiss. Fl. Or. VII, 465; Batt. et Trab. Fl. d'Alg. p. 33.

*Andropogon Arriani* Edgew. in Journ. Linn. Soc. VI (1862), 208.

*Andropogon circinnatus* Hochst. et Steud. ex Steud. Syn. Gram. 387.

*Andropogon eriophorus* Willd. Sp. Pl. IV, 90.

*Andropogon Olivieri* Boiss. Diagn. V, 76; Steud. l. c. 387.

*Andropogon commutatus* Aitchis. in Journ. Linn. Soc. XIX (1882) 191 (non Steud.).

*Cymbopogon arabicus* Nees ex Steud. l. c.

*Cymbopogon circinnatus* Hochst. in Schimp. Pl. Arab. Exsicc. ed. 2 (1844) n. 783.

*Cymbopogon Arriani* Aitchis, l. c.

*Cymbopogon laniger* Duthie in Atkins. Gaz. N. W. Ind. 640.

*Gymnanthelia lanigera* Anderss. in Schweinf. Beitr. Fl. Aethiop. 300.

*Names* :—Izkhir (Arabic) ; Ginger Grass.

*Description* :—Whole plant of a pale often glaucous green, perennial. Stem short, tufted on an annulate creeping rootstock ; roots aromatic. Leaves junciform ; lower sheaths hardened, persistent.

Panicle narrow, subsimple ; proper spathes  $\frac{1}{2}$ — $\frac{2}{3}$  inch long, longer than the peduncles of the racemes, narrowly lanceolate ; racemes  $\frac{1}{4}$ — $\frac{1}{2}$  inch long, unequal ; joints of rhachis and pedicels of upper spikelets subclavate, densely villous with long hairs, the hairs more or less concealing the sessile spikelet, the tops cupular, toothed ; spikelets 3 or 4 pairs. Sessile spikelets reaching  $\frac{1}{4}$  inch long, linear-lanceolate, acute ; callus acute, densely bearded with long whitish hairs. Glumes 4 ; lower involucrel glume  $\frac{1}{2}$  inch long, linear-lanceolate, thin, flat, glabrous, nerveless, keels scaberulous ; upper involucrel glume  $\frac{1}{6}$  inch long, ovate, acute, cymbiform, thinly membranous, 3-nerved ; lower floral glume  $\frac{1}{6}$  inch long, linear-oblong, obtuse, hyaline, 2-nerved ; upper floral glume  $\frac{1}{10}$  inch long, 2-fid, hyaline, ciliate ; awn from the sinus  $\frac{1}{2}$  inch long, slender, glabrous. Pedicellate spikelets scarcely longer than the sessile, narrowly lanceolate, purplish ; pedicels  $\frac{1}{10}$  inch long ; lower involucrel glume 7—9-nerved, glabrous, with scaberulous keels ; upper involucrel glume ovate-oblong, obtuse, 3-nerved, ciliate ; lower floral glume oblong, obtuse, hyaline, ciliate.

*Locality* :—Little Aden ; ravines of Jebel Ishan (Deff.).

*Distribution* :—N. Africa, Arabia, Syria, Central and Southern Persia, Sind, N. India.

The following species is cultivated at Shaikh Othman :

3. *Andropogon Sorghum* Brot. Fl. Lus. I, 88.

VAR. *bicolor* Hack. Androp. in DC. Monogr. Phan. VI, 519.

*English name* : Great Millet, Guinea Corn, Turkish Millet. *Arabic name* : Gherb (Schweinf.), dura (variously written dhurra, dhaura, douru), (jowari in India).

*Description* :—A tall handsome annual grass, usually very robust. Leave-blade linear-lanceolate or linear from an often rounded base, long

tapering to a fine point, 1-2 feet long,  $\frac{3}{4}$ -2 $\frac{1}{2}$  inches broad, flat, glabrous, margins serrulate, midrib stout. Panicle very dense; sessile spikelets  $\frac{1}{2}$  inch, obtusely hexagonal, awnless at length, black. Lower glume coriaceous below the middle, then deeply rugged, upper part striate hairy. Grain almost twice as long as the glume.

*Fruits* in December (Schweinf.).

*Distribution*.—Cultivated in numberless forms in the tropical and subtropical regions, particularly in the Old World, and in the warmer parts of the temperate zones of both hemispheres.

*Uses*.—Dura (jowari) is much used by the Arabs and Somalis of Aden for food. "The latter boil and eat it like rice, the former pound it on a flat stone with a stone roller, moistening, it with water at the same time till it assumes the consistence of a thick paste or dough; this is allowed to ferment for a short time, after which it is made into circular cakes of about half a pound each, and then baked in an earthen oven. These ovens are made of common mud, and are circular and funnel-shaped, about five or six feet in circumference, open at both ends like a barrel. The oven is fixed in the ground, and a hole made below to remove the ashes of the burnt fuel, and also to allow a current of air to pass through. The cakes are placed inside on hot ashes; the dry stalks of jowari are used for fuel; about forty or fifty cakes can be baked at once in a good-sized oven. There are two kinds of cake, 'Fatir' unfermented, and 'Kidr' fermented; they are hawked about, and sold at about half an anna the half-pound cake."<sup>1</sup>

For the various uses of this plant see Watt's Dict. Econ. Prod. VI, Part III, 277—317; Commerc. Prod. Ind., p. 1031—1043.

Of the genus *Saccharum* the following species is cultivated at Shaikh Othman (ex Krause):

***Saccharum spontaneum* Linn. Mant. (1771) 183.**

*Description*.—A tall erect grass reaching sometimes 20 feet high; stem erect from a stout rootstock, solid, smooth, polished, silky beneath the panicle. Leaves 1-2 $\frac{1}{2}$  feet by  $\frac{1}{8}$ - $\frac{1}{4}$  inch, narrowly linear, finely acuminate, rigid, coriaceous, usually glabrous, often with convolute margins; sheaths smooth, with fimbriate mouth; ligule ovate, membranous. Panicle 8-24 inches long, lanceolate, silky-hairy; rhachis slender; branches 3—5-nate, 2-4 inches long; rhachis of racemes almost capillary, fragile. Spikelets  $\frac{1}{2}$  inch long, lanceolate; callus minute, bearded with spreading silky hairs  $\frac{1}{2}$  inch long. Glumes 4; lower involucre lanceolate-subulate, acuminate; upper involucre glume equal to the lower, lanceolate, obscurely keeled, 1-nerved; lower floral glume

<sup>1</sup> Hunter, l. c. p. 64.

ovate-lanceolate, subacute, ciliate, hyaline, nerveless; upper floral glume very slender ciliate; pale minute, ciliate.

*Distribution* :—Throughout the warm regions of the Old World, ascending to 6,000 feet in India.

*Uses*.—The grass being large and coarse, is used mainly as a thatching material. The leaves, sheaths, etc., are twisted into rope and worked up into mats. As a fodder plant it is especially valued for feeding buffaloes.

*Zea Mays* Linn. Sp. Pl. (1753) p. 971.

The well known Maize or Indian Corn.

Cultivated at Shaikh Othman (Yerbury ex litt.).

“This grain in Arabia is called ‘ Hind ’ ; it is grown in Yemen, and is imported by land and sea, also from Mokha. It is used for bread after being made into flour, but it is more frequently eaten simply roasted. Ears of Indian corn, ready roasted, can be purchased at the street corners for two pice, or half of an anna, per head. The price per 100 is from 8 to 12 annas.” (Hunter, l. c. p. 66.)

## 2. *Pennisetum Pers.*

Perennial or annual; culms simple or often profusely branched; blades flat or convolute; ligules usually reduced to a ciliate rim or fringe of hairs, rarely membranous.

Panicle spike-like, usually dense, branches very numerous all around the axis, very short, simple with a solitary spikelet, or scantily divided with the spikelets in clusters of 2-5; the solitary spikelets or the clusters subtended by and deciduous with an involucre (very rarely a solitary bristle) of often very numerous and usually unequal scabrid or plumose simple rarely branched bristles. Lower floret male or barren, with or without a pale; upper floret hermaphrodite. Glumes usually small and hyaline, lower sometimes suppressed, upper rarely  $\frac{1}{2}$  the length of the spikelet or more and then several-to 7-nerved. Valves equal or subequal, membranous to chartaceous, 5-7-nerved, or the lower more or less reduced, thinner, fewer-nerved. Pales subequal to the valve and of similar texture, 2-nerved, or more or less reduced in the lower floret. Lodicules small, usually in front and outside the plate or 0. Stamens 3. Styles distinct, slender or connate.

Grain enclosed by the slightly changed valve and pale, broadly oblong, slightly dorsally compressed to subglobose; hilum basal, punctiform; embryo large,  $\frac{1}{2}$ - $\frac{3}{4}$  the length of the grain.

*Species* about 40.

*Distribution* :—In most warm countries, particularly in dry regions.

1. *Pennisetum cenchroides* A. Rich. in Pers. Syst. Pl. I (1805)\* 72; Beauv. Agrost. 59, t. 13, fig. 5; Nees in Linnæa VII, 277, et Fl. Afr. Austr. 70; Kunth, Enum. I, 162; Trin. Pan. Gen. 93, et in Mém Acad. Petersb. ser. 6, III, 181; Steud. Syn. Pl. Glum. I, 105; Baker Fl. Maurit. 441; Hook. Fl. Brit. Ind. VII, 88; Anders. in Journ. Linn. Soc. V, Suppl. p. 39; Stapf. in This.-Dyer Fl. Cap. VII, 433; Cooke Fl. Bomb. Pres. II, 916.

*Pennisetum ciliare* Link Hort. Bot. Berol. I, 213; Steud. Syn. Pl. Glum. I, 105; A. Rich. Tent. Fl. Abyss. II, 384; Batt. et Trab. Fl. d'Alg. p. 38; Boiss. Fl. Or. V, 445; Schweinf. Beitr. Fl. Aethiop. 301, Engl. Hochgebirgsfl. Trop. Afr. 125; Durand & Schinz. Consp. Fl. Afr. V, 778; Hack. in Bull. Herb. Boiss. IV, App. III, 16.

*Cenchrus ciliaris* Linn. Mant. Pl. 302.

*Cenchrus pennisetiformis* Hochst. et Steud. ex Boiss. Fl. Or. V, 445.

*Panicum vulpinum* Willd. Enum. Hort. Berol. 1031.

*Description* :—Perennial; culms ascending from a branched geniculate and often decumbent, many-noded base,  $1\frac{1}{2}$ -2 feet long, smooth, glabrous, or scantily hairy, upper internodes more or less exserted, the uppermost much so, and very slender; leaves quite glabrous or sometimes with scattered fine stiff hairs; sheaths tight, the lower persistent, or at length decaying, leaving the internodes naked; ligule a very narrow densely ciliate rim; blades linear, long tapering to a setaceous point 3-3 inches by  $1\frac{1}{2}$ -3 lines, usually flat, often flaccid, usually scaberulous above or along the margins.

Panicle spike-like, cylindric, dense, 1-4 inches by 4-6 lines, pallid or purplish, often flexuous; rhachis finely scaberulous like the very short pedicels; involucre of very numerous bristles, outer bristles fine scabrid, shorter or slightly longer than the spikelets, inner thickened towards the base, ciliate, much longer (about  $\frac{1}{2}$  inch long), one usually conspicuously exceeding all the rest; spikelets 3-1 within each involucre, lanceolate-oblong, 2-2 $\frac{1}{2}$  lines long, pallid, glabrous; glumes hyaline, ovate, acute or acuminate, usually 1-nerved, upper about 1 line long, lower shorter, sometimes nerveless; florets equal or subequal, lower male or barren, very rarely hermaphrodite; valves ovate-oblong, abruptly mucronate, acuminate, 5-nerved; pales subequal, truncate; lodicules 0; anthers slightly over 1 line long, tips acute, naked; styles free nearly from the base.

*Fruits* :—March (Schweinf.).

*Locality* :—In sandy plains (Hooker, Thomson); gravelly slopes and ravines of Shum Shum Range (Defl., Ellenbeck, Busse); great valley

between Steamer Point and town (Marchesetti) ; Aden, Shaikh Othman (Schweinf.).

*Distribution* :—Sicily, throughout Africa, Arabia, Sind, N. W. India, Gujarat, Deccan.

### 3. *Setaria Beauv.*

Perennials or annuals of various habit ; nodes of stem glabrous or hairy ; ligules usually reduced to a ciliate rim, rarely a distinct membrane. Panicle mostly cylindric, spike-like, dense, with the solitary or clustered spikelets on very short branches which are more or less produced into bristles beyond the spikelets or divided into a one-sided bristly involucre at their base, or more or less open with elongate branches and more distant spikelets, often with or without subtending bristles in the same inflorescence ; bristles always persistent. Spikelets ovate to oblong, falling entire from the pedicel. Lower floret male, or reduced to the valve and a more or less arrested pale ; upper floret hermaphrodite. Glumes membranous, lower generally much smaller, usually 3-5, rarely 1-or 7-nerved, upper usually 5-sometimes 7-nerved. Lower valve more or less exceeding and resembling the upper glume ; upper valve chartaceous to coriaceous, 5-nerved. Pales subequal to their valves or that of the lower floret more or less arrested, flat, 2-nerved, hyaline in the lower, of the same substance as the valve in the upper floret. Lodicules 2, broadly cuneate. Stamens 3. Styles distinct ; stigmas laterally exerted.

Grain tightly enclosed by the hardened valve and pale, oblong or ellipsoid ; hilum basal, punctiform or orbicular ; embryo about  $\frac{1}{2}$  as long as the grain.

*Species* about 40.

*Distribution* :—In the warm regions of the world, some common as weeds in the more temperate parts.

- |   |                             |
|---|-----------------------------|
| Awnlike panicle-branches scabrous with erect teeth . . .    | 1. <i>S. viridis</i> .      |
| Awnlike panicle-branches scabrous with reversed teeth . . . | 2. <i>S. verticillata</i> . |

1. *Setaria viridis* Beauv. Agrost. 51, tab. 14, fig. 3 ; Kunth Enum. Pl. I, 151 ; Aitch. Cat. Panj. Pl. 162 ; Miq. Fl. Ind. Bat. III, 467 ; Host Gram. Austr. II, t. 14 ; Fl. Dan. t. 352 ; Reichb. Ic. Fl. Germ. t. 47 ; Batt. et Trab. Fl. d'Alg. p. 37 ; Steud. Syn. Pl. Glum. I, 51 ; Boiss. Fl. Or. V, 443 ; Benth. Fl. Austral. VII, 494 ; Griseb. Fl. Brit. W. Ind. 554 ; Duthie Grass N. W. Ind. 9 ; Hook. Fl. Brit. Ind. VII, 80.

*Setaria affinis* Schult. Mant. II, 275.

*Setaria ambigua* Guss Fl. Sic. Syn. I, 114.

- Setaria chlorantha* Schur Enum. Pl. Transs. 723.  
*Setaria decipiens* C. Schimp. ex Nym. Consp. 787.  
*Setaria imberbis* Roem. et Schult. Syst. II, 891.  
*Setaria Weinmanni* Roem. et Schult. l. c. 490.  
*Setaria nana* Dum. Obs. Gram. Belg. 139.  
*Setaria penicillata* Wall. Cat. n. 8640 D.  
*Setaria villosa* Beauv. Agrost. 51.  
*Panicum bicolor* Moench. Meth. 206.  
*Panicum cynosuroides* Scop. Fl. Carn. Ed. 2, I, 50.  
*Panicum humile* Thunb. ex Trin. Gram. Panic. 164.  
*Panicum imberbe* Poir. Encycl. Suppl. IV, 272.  
*Panicum laevigatum* Lam. Fl. Fr. III, 578.  
*Panicum psilocaulum* Steud. Syn. Gram. 50.  
*Panicum purpurascens* Opiz in Flora V, 266 ; Raddi ex Nees Agrost. Bras. 240.  
*Panicum quale* Linnaei Krock Fl. Siles. I, 88.  
*Panicum reclinatum* Vill. Hist. Pl. Dauph. II, 64.  
*Panicum tejucense* Nees ex Trin. Gram. Panic. 166.  
*Panicum virescens* Salzm. ex Doell in Mart. Fl. Bras. II, II, 157.  
*Panicum viride* Linn. Syst. Veg. ed. 10, p. 870 ; Anders. Journ. Linn. Soc. V, Suppl. p. 39 ; Trin. Sp. Gram. Ic. t. 203.  
*Pennisetum viride* R. Br. Prodr. 195.  
*English name* :—Green Bristle-Grass.

*Description* :—An annual ; stems numerous, more or less geniculate, branched towards the base, erect or ascending, 3-18 inches high. Leaves 1-6 inches long by  $\frac{1}{4}$ - $\frac{3}{4}$  inch broad, lively green with a paler midrib, with rather distant scabrous ribs and strongly scabrous margins. Ligule composed of a tuft of hairs. Panicle  $\frac{1}{2}$  to 3 inches long. Bristles  $\frac{1}{4}$ - $\frac{1}{2}$  inch long.

The spikelike panicle 1-2 inches long in the typical form, but occasionally nearly twice that, the lower spikelets in distinct clusters or on short branches, the awnlike branches more irregular and often shorter, the asperities directed upwards. Outer glume acute, about  $\frac{1}{2}$  the length of the spikelet ; second and third glumes nearly equal, broad, concave, 5- or 7-nerved.

Fruiting glumes smooth and shining, the minute transverse wrinkles visible only under a lens.

*Locality* :—Aden, in umbris arbuscularum (Anders.).

*Distribution* :—Temperate and subtropical regions of the world. According to Amphlet and Rea (the Botany of Worcestershire p. 397) "this plant is a native of Manchuria which has become a weed of cultivated and waste ground throughout the greater part of the north temperate zone."



2. *Setaria verticillata* Beauv. Agrost. 51; Kunth Enum. Pl. I, 152; Wall. Cat. n. 8642 A. B. C. D. in part, E. F.; Dalz. & Gibs. Bomb. Fl. 294; Aitch. Cat. Panj. Pl. 162; Trim. Cat. Ceyl. Pl. 105; Duthie Grass. N. W. Ind. 9, Fodd. Grass. N. Ind. 15; Benth. Fl. Austral. VII, 494; Host Gram. Austr. t. 13; Reichb. Ic. Fl. Germ. t. 47, fig. 1465; T. Nees Gen. Fl. Germ. Monoc. n. 22; Eng. Bot. ed. 3, t. 1694; Sowerb. Brit. Grass. 63, t. 52; Durand & Schinz Consp. Fl. Afr. V, 774; Hack. in Bull. Herb. Boiss. IV, Append. III, 16; Hook. Fl. Brit. Ind. VII, 80; Stapf. in This.-Dyer Fl. Cap. VII, 429.

*Setaria floribunda* Spreng. Syst. I, 305; Wall. Cat. n. 8642 E.

*Setaria nubica* Link. Hort. Berol. I, 220; Kunth l. c.

*Setaria respiciens* Hochst. ex Miq. Fl. Ind. Bat. III, 467.

*Setaria verticilliformis* Dum. Fl. Belg. 150.

*Setaria Rottleri* Spreng. Syst. Veg. I, 304; Steud. Syn. Gram. 153; Kunth l. c. 153.

*Panicum aparine* Steud. 52.

*Panicum adhaerens* Forsk. Fl. Aegypt.-Arab. p. 20.

*Panicum asperum* Lamk. Fl. Fr. III, 577.

*Panicum floribundum* Willd. ex Spreng. Syst. I, 306.

*Panicum humile* Trin. Gram. Panic. 167.

*Panicum italicum* Ucria Hort. Reg. Panorm. 54.

*Panicum respiciens* Hochst. ex A. Rich. Tent. Fl. Abyss. II, 379.

*Panicum rude* Lamk. ex Steud. Nom. ed. 1, 589, 772.

*Panicum verticillatum* Linn. Sp. Pl. ed. 2, 82; Roxb. Fl. Ind. I, 301; Thw. Enum. 361; Trin. Sp. Gram. Ic. t. 202; Eng. Bot. t. 874; Host Gram. Austr. II, t. 13; Nees Fl. Afr. Austr. 53; Pan. Gen. 137 et in Mém. Acad. Petersb. ser. 6, III, 225; Steud. Syn. Pl. I, 52.

*Description* :—Annual; culms erect or ascending from a geniculate base,  $\frac{1}{2}$ -5 feet long, usually compressed below, more or less branched, glabrous, smooth, or scabrid below the panicle, 4-9-noded, internodes mostly at length exserted; sheaths thin, rather lax, usually compressed, striate, glabrous or finely hairy upwards; ligules short, truncate, dorsely ciliate; blades linear or lanceolate-linear from a broad and rounded, or from a narrow base, long tapering to an acute or subsetaceous point, 2-12 inches by 2-6 (rarely up to 12) lines, thin, flat, flaccid, scaberulous, usually finely and scantily hairy.

Panicle erect or curved, spike-like, cylindric or oblong, dense or rather lax, 1-5 inches long, coarsely bristly; axis scabrid and often pubescent; branches spirally arranged, close, in robust specimens the lower up to 4 lines long with a distinct scabrid angular rhachis and 2-nate spikelets, otherwise very short or reduced to sessile clusters, each spikelet subtended by a coarse reversely scabrid bristle 2-7 lines long,

spikelets ellipsoid, obtuse, about 1 line long, light green, glabrous; lower glume hyaline, broad, ovate, acute, 1- to sub-3-nerved,  $\frac{1}{3}$ - $\frac{2}{5}$  as long as the spikelet, upper membranous, elliptic, concave, 5-7-nerved, equal to the spikelet or almost so; lower floret barren; valve similar to the upper glume, dorsally flattened, 5-7-nerved, pale hyaline, more or less arrested or 0; hermaphrodite floret elliptic-oblong, plani-convex, subapiculate or obtuse, almost 1 line long, greenish or straw-coloured; valve subcoriaceous, very obscurely wrinkled, 5-nerved, anthers  $\frac{3}{8}$  line long.

Grain broadly ellipsoid, over  $\frac{1}{4}$  line long, white, subtranslucent.

*Locality* :—Aden (Birdw.).

*Distribution* :—Throughout Africa and India to Malaya, elsewhere (Europe, Australia, America) only as a weed.

#### 4. *Tricholæna* Schrad.

Erect tufted perennial (rarely annual) grasses. Leaves narrow; ligule a fringe of hairs. Spikelets oblong, laterally compressed, more or less gaping, paniced, deciduous from capillary pedicels; lower floret usually male or barren, upper hermaphrodite. Glumes very dissimilar or at least unequal, lower reduced to a minute scale or obsolete, very rarely half the length of the spikelet, somewhat remote from the upper; upper glume membranous, emarginate, mucous or finely mucronate or aristate from the sinus, 5-nerved, usually hairy. Valves very dissimilar, lower like the upper glume with a hyaline 2-nerved subequal pale, upper much smaller, thinly chartaceous, glabrous, shining, obtuse or submarginate, obscurely 5-nerved with an equal 2-nerved pale of similar substance. Lodicules 2, very small. Stamens 3. Style free, slender; stigma densely plumose, laterally exserted.

Grain oblong-ellipsoid, closely embraced by the valve and pale; hilum basal, punctiform; embryo about  $\frac{1}{2}$  the length of the grain.

*Species* about 12.

*Distribution* :—In the dry and hot countries of the Old World, chiefly African.

*Tricholæna Teneriffæ* Parlat. in Webb et Berth. Phyt. Canar. III, part 2 (1848) p. 425, Fl. Ital. I., 30; Anders. Journ. Linn. Soc. V, Suppl. p. 38; Boiss. Fl. Or. V, 434; Hook. Fl. Brit. Ind. VII, 65; Cooke Fl. Bomb. Pres. II, 924.

*Tricholæna micrantha* Schrad. in Sch. Mant. II, 163; Nees in Ann. Sc. Nat. ser. 2, VI (1836) 106.

*Panicum plumosum* Presl Fl. Sic. I, 43.

*Panicum saccharoides* Trin. Gram. Panic. 245.

*Panicum Teneriffæ* Br. Prodr., 189 ; Kunth Enum. Pl. I, 98, Suppl.

75.

*Panicum villosum* Presl Gram. et Cyp. Sic. 18.

*Saccharum Teneriffæ* Linn. f. Suppl. 106, Jacq. Eclog. Gram. 51, t.

34 (excl. syn.) ; Biv. Bern. Stirp. Sic. Rar. IV, 5, t. 1 ; Sibth. Fl. Graec. I, t. 53 (excl. Anal.).

*Agrostis plumosa* Ten. Fl. Nap. Prodr. Suppl. I, 59.

*Description* :—Perennial ; stems many from a woody rootstock, geniculate below, slender, rigid. Leaves  $1\frac{1}{4}$ -3 by  $\frac{1}{16}$ - $\frac{1}{8}$  inch, narrowly linear-lanceolate, finely acuminate, convolute, rigid, glabrous ; sheaths glabrous ; ligule a narrow softly hairy ridge.

Inflorescence of slender erect panicles  $2\frac{1}{2}$ -4 $\frac{1}{2}$  inches long ; branchlets and pedicels capillary. Spikelets up to  $\frac{1}{6}$  inch long, clothed with silky hairs. Glumes 3 (rarely 4) ; involucrel glume minute or obsolete ; upper involucrel glume  $\frac{1}{8}$  inch long, ovate, acute, densely silky ; lower floral glume  $\frac{1}{6}$  inch long, ovate, acute, apiculate, paleate, the palea narrowly oblong, subobtuse, hyaline ; upper floral glume  $\frac{1}{10}$  inch long, ovate-oblong, obtuse, coriaceous, shining ; palea as long as the glume, oblong-lanceolate, subacute. Anthers  $\frac{1}{10}$  inch long, narrowly linear. Stigmas  $\frac{1}{10}$  inch long, exserted, sessile or nearly so, plumose.

*Fruits* :—November (Schweinf.).

*Locality* :—Basaltic lava above the coal-dépôts of the Messag. Marit. (Schweinf.) ; plain of Maala (Defl.) ; great valley between Steamer Point and town (Marchesetti) ; without locality (Edgew., Hook., Thomson).

*Distribution* :—Sicily, Canaries, Cape Verd Islands, N. Africa, Arabia, Sind, Punjab, W. peninsula of India.

## 5. *Panicum* Linn.

Annual or perennial grasses of various habit. Leaves broad or narrow ; ligules usually reduced to a ciliate rim or a fringe of hairs (rarely a distinct membrane) or 0.

Inflorescence various. Spikelets small, 1-2-flowered, terete or dorsally or laterally compressed, solitary or 2-nate, often secund, ovoid or oblong, articulate at the base and deciduous, rarely awned. Glumes 4 ; involucrel glumes empty ; the lower the smallest (sometimes minute) and fewest-nerved ; upper involucrel glume usually equal or almost equal to the lower floral glume, sometimes cuspidate, 5-13-nerved ; lower floral glume equalling the upper or longer, more or less resembling the upper involucrel glume, usually neuter, paleate or not ; upper floral glume coriaceous to crustaceous, sometimes shortly stipitate,

convex, bisexual, the palea usually as long as and of the same texture as the glume. Lodicules 2, cuneate. Stamens 3. Styles distinct; stigmas laterally exerted near the tops of the spikelet.

Grain free, but tightly enclosed by the hardened glume and palea, oblong, ellipsoid or lanceolate.

*Species* between 200 and 250.

*Distribution*:—Mainly in the warm regions of the world.

Inflorescence of spiciform or effuse panicles :		1
Panicles elongate . . . . .		1. <i>P. leucanthum</i> .
Panicles broad, effuse :		
Lower involucrel glume as long as the lower floral glume or nearly so . . . . .		3. <i>P. turgidum</i> .
Lower involucrel glume shorter than the lower floral glume . . . . .		4. <i>P. antidotale</i> .
Panicles pauciradiate . . . . .		5. <i>P. leersioides</i> .
Inflorescence racemose, of simple spikes . . . . .		2. <i>P. colonum</i> .

**1. *Panicum leucanthum*** A Rich. Tent. Fl. Abyss. II, 372 ; Walp. Ann. Bot. III, 718 ; Steud. Syn. Pl. Glum. I, 92.

*Tricholæna leucantha* Hochst. in Schimp. Pl. Abyss. n. 1818.

*Description*:—Stem erect, ramose, slender, 2 feet high ; leaves narrow, glaucous, convolute, glabrous, smooth ; ligule silky, short ; sheaths glabrous.

Panicle elongate ; branches erect, flexuose ; branchlets thickened at the ends, truncate, glabrous, smooth ; spikelets articulate at the base, deciduous, oblong, narrow, 2-flowered. Involucrel glumes lanceolate, equal, acute, ciliate, covered with very long setose hairs. Male flower with 2 pales, linear ; pales of hermaphrodite flower coriaceous, glabrous, awnless, shining.

*Locality*:—Gravelly slope of Shum Shum Range (Ellenbeck). We have not seen the specimen.

*Distribution*:—Yemen, Eritrea, Abyssinia.

**2. *Panicum colonum*** Linn. Syst. ed. 10, 870 ; Jacq. Eclog. Gram. t. 32 ; Ehret. Ic. Sel. t. 3, f. 3 ; Beauv. Agrost. t. X, f. 6 ; Trin. Sp. Gram. Ic. t. 160 ; Steud. Syn. Gram. 46 ; Wall. Cat. n. 8685 ; Trim. Cat. Ceyl. Pl. 104 ; Duthie Grass. N. W. Ind. 3, et Indig. Fodd. Grass. t. 4, et Fodd. Grass. N. Ind. 4 ; Benth. Fl. Hongk. 411, Fl. Austral. VII, 478 ; Boiss. Fl. Or. V, 435 ; Franch. & Sav. En. Pl. Jap. II, 160 ; Griseb. Fl. Brit. W. Ind. 545 ; Hook. Fl. Brit. Ind. VII 32 ; Cooke Fl. Bomb. Presid. II, 931.

*Panicum arabicum* Nees ex Steud. Nom. ed. 2, II, 251, Syn. Gram. 63.

*Panicum brizoides* Linn. Mant. I, 184.

*Panicum caesium* Nees in Hook. and Arn. Bot. Beech. Voy. 235; Steud. l. c. 47.

*Panicum confertum* Herb. Rottl. ex Wall. Cat. n. 8687 B.

*Panicum Crus-galli* Wall-Cat. n. 8687 I; var. *colonom* Coss. Expl. Alger. 28; var. *minor* Thw. Enum. Pl. Zeyl. 359.

*Panicum cuspidatum* Roxb. Fl. Ind. I, 298; Duthie Grass. N. W. Ind. 3; Steud. l. c.; Fig. & de Not. in Mem. Acad. Tor. (1854), 340, t. XIII, f. 1—16.

*Panicum Daltoni* Parlat. ex Webb in Hook. Niger Fl. 185; Steud. l. c.

*Panicum flaccidum* Wall. Cat. n. 8692 H (partim).

*Panicum grossarium* Griff. Notul. III, 36, Ic. Pl. Asiat. t. 139, f. 113.

*Panicum haematodes* Presl Fl. Sic. I, 43.

*Panicum numidianum* Presl Cyp. et Gram. Sic. 19.

*Panicum Petiveri* Kotsch ex Griseb. Fl. Brit. W. Ind. 545.

*Panicum pseudo-colonom* Roth Nov. Sp. 147.

*Panicum semiverticillatum* Herb. Rottl. (non Rottl. in Ainsl. Mat. Med.).

*Panicum tetrastichum* Forsk. Fl. Aeg.-Arab. 19.

*Panicum zonale* Presl Prodr. Fl. Sic. I, 82.

*Oplismenus colonus* H. B. & K. Nov. Gen. et. Sp. I, 108; Kunth Enum. Pl. I, 142; Dalz. & Gibs. Bomb. Fl. 291; Aitchis. Cat. Panj. Pl. 161.

*Oplismenus pseudo-colonus* Kunth Rev. Gram. I, 44, Enum. I, 142.

*Description* :—Annual; stem 1-2 feet long, slender, decumbent or shortly creeping below; nodes glabrous or puberulous. Leaves 4-8 by  $\frac{1}{8}$ – $\frac{1}{2}$  inch, narrowly lanceolate or linear, acuminate, flat, glabrous, with scaberulous margins; sheaths up to 6 inches long; ligule 0.

Spikes 8-20, suberect, usually distant,  $\frac{1}{2}$ –1 inch long; rhachis stout, angular, scaberulous on the angles. Spikelets  $\frac{1}{2}$ – $\frac{1}{10}$  inch long, globose, ovoid, acute or subcuspidate, more or less hispidly pubescent, secund, sessile, 3-5 seriate. Glumes 4; lower involucre glume about  $\frac{1}{2}$  as long as the lower floral glume, broadly ovate or suborbicular, membranous, 3-nerved, ciliolate; upper involucre glume about equal to the lower floral glume, broadly ovate, cuspidate, concave, 5-7-nerved, hairy; lower floral glume similar, empty, with a hyaline palea; upper floral glume coriaceous, broadly ovate, turgid, acute, finely striolate, polished, yellowish-white, with a coriaceous palea.

*Flowers and fruits* from January to March (Schweinf.).

*Locality* :—Shaikh Othman (Schweinf.).

*Distribution* :—Most warm countries.

*Uses* :—This plant is an excellent fodder grass. (*c.f.* Church, Food Grains of India, 1886, p. 50).

**3. *Panicum turgidum* Forsk.** Fl. Aeg.-Arab (1775) p. 18; Del. Fl. Aegypt. Ill. 51, t. 9, f. 2; Nees Agrost. Bras. I, 172 (in nota); Trin. Pan. Gen. 221, Sp. Gram. Ic. t. 227; Kunth Enum. Pl. I, 97; Steud. Syn. Gram. 88; Duthie Fodd. Grass. N. Ind. p. 13; Hook. Fl. Brit. Ind. VII, 44; Cooke Fl. Bomb. Pres. II, 935.

*Arabic Name* :—Thomam.

*Description* :—Perennial, glabrous, glaucous; rootstock sometimes as thick as the little finger; root-fibres thick, velvety; stem hard, (bamboo-like), solid, smooth and polished,  $\frac{1}{10}$ – $\frac{1}{8}$  inch in diameter about the middle, emitting from the nodes fascicles of branches in tufts from a swollen base. Leaves few, those at the base of the stem and branches 1-3 inches long, flat, coriaceous, linear-lanceolate, acuminate, smooth, those of the upper nodes often reduced to open chartaceous sheaths with a setiform blade.

Panicle terminal, subpyramidal,  $1\frac{1}{2}$ –4 inches long; branches at first erect, then more or less spreading,  $\frac{1}{2}$ – $1\frac{1}{2}$  inches long; rhachis angular, grooved, glabrous. Spikelets  $\frac{1}{3}$ – $\frac{1}{2}$  inch long, solitary, or rarely 2-nate, subsecund, ovoid, turgid, glabrous, white; pedicels short or long, with a cupular tip, scaberulous. Glumes 4, subcoriaceous; lower involucreal glume scarcely shorter than the upper, and about equalling the lower floral glume, broadly ovate, acute, concave, .5-7-nerved; upper involucreal glume broadly ovate, acute, 7-nerved; lower floral glume ovate, acuminate, 9-nerved, paleate, male; upper floral glume much smaller than the lower, ovate-oblong, acute, smooth, polished. Anthers purple. Styles short; stigmas short, pale purple.

*Locality* :—Little Aden (Def., Schweinf.).

*Distribution* :—Nubia, Abyssinia, Egypt, Palestine, Arabia, Socotra, S. Persia, Baluchistan, Sind, Gujarat.

This is the most common plant of the Nubian steppe.

**4. *Panicum antidotale* Retz.** Obs. fasc. IV (1786), p. 17; Trin. Gram. Pan. 227, Pan. Gen. 195; Nees Agrost. Bras. 201; Kunth Enum. Pl. I, 125; Steud. Syn. Gram. 77; Wight Cat. n. 1630; Thw. Enum. Pl. Zeyl. 360; Trim. Cat. Ceyl. Pl. 105; Aitchis. Cat. Panj. Pl. 158; Duthie Grass. N. W. Ind. 2, Fodd. Grass. t. 3, Fodd. Grass.

N. Ind. 4; Benth. Fl. Austral. VII, 483; Boiss. Fl. Or. V, 440; Hook. Fl. Brit. Ind. VII, 52; Trim. Fl. Ceyl. V, 156; Cooke Fl. Bomb. Pres. II, 937.

*Panicum maximum* Wall. Cat. n. 8715 B (partim) C (partim).

*Panicum polygamum* Herb. Madr. ex Wight Cat. n. 1630.

*Panicum pruinatum* Bernh. ex Trin. Pan. Gen. 191.

*Panicum subalbidum* Kunth Revis. Gram. II, 397. t. 112, Enum. 1.

*Panicum tenue* Roxb. ex Wight Cat. sub n. 1628 (non Fl. Ind.)

*Milium arundinaceum* Koen. ex Wight. Cat. l.c.

*Description*:—A tall glabrous perennial grass reaching 5 feet high; rootstock creeping, stoloniferous; stem solid, woody, terete, smooth; nodes thickened, the lower sometimes rooting. Leaves 6-24 by  $\frac{1}{4}$ - $\frac{3}{4}$  inch, linear, very finely acuminate with capillary tips; sheaths long, glabrous, striate, with naked margins; ligule short, membranous, jagged or fimbriate.

Panicle 6-9 inches long, effuse, pyramidal; rhachis very slender, angular, glabrous, or slightly scaberulous; branches usually fascicled (the upper sometimes solitary), 3-4 inches long, filiform, spreading and drooping; branchlets capillary. Spikelets laxly crowded on the branchlets, reaching  $\frac{1}{2}$  inch long or slightly longer, ovoid, acute, glabrous. Glumes 4; lower involucrel glume half as long as the upper, broadly ovate, subobtusely, 3-nerved, hyaline; upper involucrel glume broadly ovate, acuminate, 7-9-nerved, membranous; lower floral glume equal and similar to the upper involucrel glume, paleate, empty or male, the palea oblong, subacute, hyaline, as long as the glume; upper floral glume coriaceous, elliptic, obtuse, with incurved margins, dorsally smooth, yellowish-white; palea thinly coriaceous, ovate, acute, as long as the glume. Anthers linear-oblong. Styles 2, distinct, conspicuous, very plumose.

*Flowers and fruits*:—December (Schweinf.).

*Locality*:—Shaikh Othman, as a weed in watered places of gardens (Schweinf.).

*Distribution*:—Tropical Africa, Afghanistan, Punjab, Upper Gangetic Plain, Sind, Gujarat, Southern Maratta Country, W. Peninsula of India, Ceylon, tropical Australia.

5. *Panicum leersioides* Hochst. in Flora (1855) p. 196; Schweinf. in Bull. Herb. Boiss. II (1894), Append. 2, p. 21; Durand & Schinz, Consp. Fl. Afr. V (1895), p. 752, no. 98.

*Description*:—Culms 1-2 feet high, branched below from an apparently annual root; sheaths and leaves glabrous or with long

scattered pilose hairs. Leaves flat, linear, elongate, long acuminate, flaccid, scabrous on the margins ; ligule ciliate.

Panicle pauciradiate ; radii remote, solitary, 1-3 inches long, patent ; rachis of radii subtriquetrous, scabrous on the angles and sparingly pilose. Spikelets mostly solitary, short-pedicellate ; inferior glume less than half the length of the spikelet, broadly ovate, 1-nerved, a little remote from the superior glume which is as long as the spikelet and 5-nerved ; the neuter flowers often bivalved, the lower valve as long as the superior glume and 5-nerved ; both valves of hermaphrodite flowers deeply rugulose.

*Locality* :—Aden (Birdwood).

*Distribution* :—Abyssinia, Eritrea.

## 6. *Digitaria* Rich.

Annual or perennial grasses. Leaves linear or lanceolate. Spikelets usually 2-3-nate, in digitate or racemose spikes, jointed on the pedicel, but not thickened at the base ; lower floret barren, reduced to the floral glume and a very minute palea ; upper floret hermaphrodite. Glumes very dissimilar, normally 4 ; the lower involucrel glume usually hyaline, sometimes absent or present in the same species ; the upper involucrel glume membranous, 1-5-nerved or nerveless ; floral glumes equal or subequal, the lower like the upper involucrel glume, usually 7-9-nerved, the nerves close, parallel, straight, prominent ; upper floral glume chartaceous or subchartaceous, usually 3-nerved. Palea of upper floret subequal to the glume, and of same texture, 2-nerved. Lodicules 2, minute, broadly cuneate. Stamens 3. Styles distinct ; stigmas plumose, laterally exserted near the apex of the floret.

Grain oblong, slightly dorsally compressed, free, but tightly enclosed between the hardened glume and the palea.

*Species* about 50.

*Distribution* :—Mostly in warm parts of the Old World.

*Digitaria pennata* T. Cooke in Fl. Bomb. Pres. II, 941.

*Panicum pennatum* Hochst. in Flora XXXVIII (1854) 197.

*Paspalum pennatum* Hook. f. Fl. Brit. Ind. VII, 16 ; Woodr. in Journ. Bomb. Nat. Hist. Soc. XIII (1901) 433.

*Description* :—Stems 2 feet long, tufted, leafy. Leaves 1-6 by  $\frac{1}{8}$ - $\frac{1}{4}$  inch, linear or linear-lanceolate, finely acuminate, glabrous or sparsely hairy, distantly ciliate with long, fine, bulbous-based hairs ; sheaths long, striate, glabrous or with a few scattered hairs ; ligule long, oblong, membranous.



Spikes several, radiating, 3-6 inches long; rhachis very slender, trigonous, with numerous long cilia. Spikelets erect, solitary or 2-nate,  $\frac{1}{8}$  inch long, narrowly lanceolate, acute, subsilky. Glumes normally 4 lower involucrel glume minute, ovate, acute (rarely absent); upper involucrel glume lanceolate, acute, membranous; lower floral glume similar to the upper involucrel glume, 3-5-nerved; upper floral glume chartaceous, lanceolate, acuminate, nearly equal to the lower.

*Locality*.—Aden (Birdwood).

*Distribution*.—Abyssiniä, Arabia, Baluchistan, Sind, Gujarat.

## 7. *Eriochloa* H. B. & K.

Annual or perennial grasses. Leaves flat, lanceolate or ovate-lanceolate.

Spikelets 1-flowered, aristulate, secund on the spiciform branches of a raceme or panicle, the base thickened and articulate on the thickened apex of the short pedicel. Glumes 3; lower involucrel glume absent; upper involucrel glume subequal to the lower floral glume; upper floral glume paleate, rather shorter than the lower, apiculate, hardening in fruit. Lodicules truncate. Stamens 3; anthers linear. Styles 2, free; stigmas plumose, subapically exserted.

Grain oblong, free, between the hardened glume and the palea.

*Species* perhaps 5.

*Distribution*.—Tropical.

*Eriochloa polystachya* H. B. & K. Nov. Gen. & Sp. I (1815) 95, f. 31; Lam. Encycl. t. 909; Kunth Enum. Pl. I, 72, Suppl. 53; Trim. Cat. Ceyl. Pl. 104; Duthie Indig. Fodd. Grass. t. 41, Fodd. Grass. N. Ind. 2; Hook. Fl. Brit. Ind. VII, 20; Trim. Fl. Ceyl. V, 126; Woodr. in Journ. Bomb. Nat. Hist. Soc. XIII (1901) 433; Prain Beng. Pl. 1183; Cooke Fl. Bomb. Pres. II, 944.

*Eriochloa annulata* Kunth Revis. Gram. I, 30, Enum. I, 73; Aitchis. Cat. Panj. Pl. 158; Duthie Grass. N. W. Ind. 2; Benth. Fl. Hongk. 409, Austral. VII, 463.

*Eriochloa punctata* Ham. Prodr. Fl. Ind. Occ. 5; Kunth Enum. I, 72; Miq. Fl. Ind. Bat. III, 441; Benth. Fl. Austral. VII, 462.

*Eriochloa sundaica* Miq. l. c. 606.

*Eriochloa succincta* Kunth Enum. I, 73.

*Helopus annulatus* Nees in Mart. Fl. Bras. II, 17; Wight Cat. n. 1605; Wall. Cat. n. 8750.

*Helopus laevis* Trin. ex Spreng. Neue Entdeck. II, 49, f. 4.

*Helopus pilosus* Trin. Fund. Agrost. 104, f. 4.

*Helopus acrotrichus* Steud. Syn. Gram. 100.

*Paspalum punctatum* Fluegge Gram. Monog. 127 (*Paspalus*) ; Trin. Sp. Gram. Ic. t. 155.

*Paspalum annulatum* Fluegge l. c. 133 (*Paspalus*) ; Trin. l. c. t. 133.

*Paspalum succinctum* Trin. Diss. II, 19, Sp. Gram. Ic. t. 156.

*Milium Carar* Herb. Ham. ex Wall. Cat. n. 8750 F.

*Milium Languchinia* Herb. Ham. l. c. n. 8750 G.

*Milium polystachyum* Spreng. Syst. I, 251.

*Milium punctatum* Linn. Amoen. Acad. V, 392, Sp. Pl. 91; Br. Prodr. 188.

*Milium orixense* Roxb. Ic. ined. n. 818.

*Milium ramosum* Retz. Obs. VI, 22; Roxb. Fl. Ind. I, 316; Griff. Notul. III, 15, Ic. Pl. Asiat. t. 139, f. 60.

*Piptatherum punctatum* Beauv. Agrost. 18, t. 5, f. 1.

*Piptatherum confine* Schult. Mant. II, 184 (ex Kunth).

*Piptatherum annulatum* Raddi Agrost. Bras. 30.

*Agrostis punctata* Lamk. Encycl. I, 58.

*Oedipachne punctata* Link Enum. Hort. Berol. I, 51.

*Description* :—Perennial, densely tufted, 2-5 feet high ; rootstock short, creeping ; stems leafy, ascending from a creeping base, stout or slender, simple or branched, glabrous except the nodes. Leaves 3-8 by  $\frac{1}{6}$ - $\frac{1}{5}$  inch, linear or linear-lanceolate, acuminate, glabrous ; sheaths glabrous ; ligule a villous ridge.

Panicles 2-5 inches long ; peduncles long or short ; rachis slender, angular, smooth ; branches of panicle (spikes) alternate, 1-2 inches long, suberect, angular. Spikelets silvery,  $\frac{1}{8}$ - $\frac{1}{6}$  inch long, loosely imbricate, shortly pedicellate, distichous, solitary or 2-nate, elliptic-lanceolate, acuminate. Lower involucral glume 0 ; upper involucral glume oblong-lanceolate, acuminate, obscurely 3-nerved, silky-hairy, membranous ; lower floral glume similar to the upper involucral glume ; upper floral glume much shorter than the lower, elliptic-oblong, obtuse, apiculate, thinly coriaceous, pale, shining ; palea oblong with incurved margins. Anthers linear.

Grain oblong, free within the hardened glume and palea.

*Locality* :—Shaikh Othman, on cultivated ground (Schweinf.).

*Distribution* :—Most hot countries.

### S. *Aristida* Linn.

Annual or more often perennial, tufted, usually with more or less wiry culms ; blades narrow, usually convolute ; ligule usually a line of very short hairs.

Panicle varying from spike-like to effuse. Spikelets 1-flowered, narrow, paniced, rachilla disarticulating above the glume, not produced. Glumes usually persistent, narrow, 1-3-nerved, muticous or mucronate, awnless. Valve convolute, cylindric or oblong cylindric, 3-nerved, awned, rather rigid, tips gradually tapering or minutely bilobed, sometimes jointed at or above the middle; callus villous, shortly bearded, usually pungent; awn nearly always tripartite from the base or above the simple base, very rarely simple, continuous with the valve or disarticulating from it or deciduous with a portion of the valve, foot straight or twisted, bristles plumose or the lateral or all naked. Palea small, oblong, 2-nerved or nerveless. Lodicules 2, finely nerved. Stamens 3. Ovary glabrous; styles distinct, short; stigmas plumose, laterally exserted.

Grain slender, cylindric or oblong-cylindric, terete, sometimes grooved, lightly embraced by the valve; hilum linear, almost as long the grain; embryo short or long.

*Species* about 100.

*Distribution* :—In the dry and warm regions of both hemispheres

Awn tripartite from the base :

Glumes not equal :

Stems  $\frac{1}{2}$ -3 ft. high . . . . . 1. *A. Adscensionis*.

Stems up to 4 inches high . . . . . 2. *A. pumila*.

Glumes equal . . . . . 7. *A. mutabilis* var.

Awn feathery :

Leaves rigid :

Sheath glabrous . . . . . 3. *A. brachypoda*.

Sheath not glabrous . . . . . 6. *A. plumosa*.

Leaves flexuous :

Lower glume longer than the upper . . . . . 5. *A. hirtigluma*.

Lower glume shorter than the upper . . . . . 4. *A. paradisica*.

1. *Aristida Adscensionis* Linn. Sp. Pl. ed. I, p. 82; Kunth Enum. Pl. I, 190; Willd. Sp. Pl. I, 458; Trin. et Rupr. Stip. 138; Steud. Syn. Pl. Glum. I, 139; Anders. Journ. Linn. Soc. V, Supplem. p. 39; Boiss. Fl. Or. V, 491; Batt. et Trab. Fl. d'Alg. 56; Baker Fl. Maurit. 450 Durand & Schinz Consp. Fl. Afr. 799; Hook. Fl. Brit. Ind. VII, 224; Cooke Fl. Bomb. Pres. II, 1008.

*Aristida paniculata* Forsk. Fl. Aegypt.-Arab. 25 (?)<sup>1</sup>.

*Aristida americana* Linn. in Amœn. Acad. V, 393 (not Swartz).

*Aristida gigantea* Linn. Fl. Suppl. 113.

*Aristida depressa* Retz. Obs. IV, 22.

*Aristida cærulescens* Desf. Fl. Atlant. I, 109, t. 21, fig. 2; Schum. & Thonn. Beskr. Guin. Pl. 47; Trin. Sp. Gram. Ic. t. 313.

<sup>1</sup> Synonymy after Stapf.

- Aristida interrupta* Cav. Ic. V, 45, t. 471, f. 2.  
*Aristida elatior* Cav. Ic. VI, 65, t. 589, f. 1.  
*Aristida canariensis* Willd. Enum. 99.  
*Aristida humilis* H. B. & K. Nov. Gen. et Spec. I, 121.  
*Aristida bromoides* H. B. & K. l. c. 121.  
*Aristida coarctata* H. B. & K. l. c. 122.  
*Aristida divaricata* Jacq. Eclog. Gram. 7, t. 6 (not Willd.).  
*Aristida mauritiana* Kunth Revis. Gram. I, 61; Trin. & Rupr. Stip. 139.  
*Aristida setacea* Trin. Gram. Gen. 84 (not Retz).  
*Aristida nigrescens* Presl Reliq. Haenk. I, 223.  
*Aristida cognata* Trin. & Rupr. Stip. 127.  
*Aristida dispersa* Trin. & Rupr. l. c. 129.  
*Aristida festucoides* Hochst. & Steud. (not Poir.) ex Trin. & Rupr. l. c. 129.  
*Aristida laxa* Willd. (not Cav.) ex Trin. & Rupr. l. c. 130.  
*Aristida vulgaris* Trin. & Rupr. l. c. 131-136 (excl. vars. *aethiopica senegalensis*, *Ehrenbergii*, *spicigera*).  
*Aristida nutans* Ehrenb. & Hempr. ex Trin. and Rupr. l. c. 135.  
*Aristida pusilla* Trin. & Rupr. l. c. 140; Steud. Syn. Pl. Glum. I 139; Durand & Schinz Consp. Fl. Afr. V, 807.  
*Aristida swartziana*  
*Aristida maritima*  
*Aristida nana*  
*Aristida arabica*  
*Aristida tenuiflora*  
*Aristida modatica*  
*Aristida simplicissima* } Steud. Syn. Pl. Glum. I, 137-139.  
*Aristida chaetophylla* Steud. l. c. 420.  
*Aristida Teneriffae* Steud. l. c. 420.  
*Aristida macrochloa* Hochst. in Flora (1855), 200.  
*Aristida vulpioides* Hance in An. Sc. Nat. ser. 5, V, 251.  
*Aristida Heymanni* Regel in Act. Hort. Petrop. VII (1880) 649.  
*Chaetaria ascensionis*  
*Chaetaria canariensis*  
*Chaetaria caerulea*  
*Chaetaria depressa*  
*Chaetaria elatior*  
*Chaetaria gigantea*  
*Chaetaria interrupta*  
*Chaetaria humilis*  
*Chaetaria bromoides*  
*Chaetaria coarctata* } Beauv. Agrost. 30.  
} Roem. & Schult. Syst. II, 396.

*Chaetaria nana* Nees ex Steud. Nom. ed. 2, I, 340.

*Chaetaria mauritiana* Nees Fl. Afr. Austr. 188.

*Description* :—Annual or occasionally perennial with an oblique rhizome, glabrous; culms tufted, geniculately ascending, slender, from a few inches to 2 feet long, usually branched from one or several of the lower nodes, smooth, upper internodes long exserted; sheaths tight, rather firm, smooth; ligule a line of short hairs; blades very narrow, linear, tapering to a very fine point, 1-9 inches long, up to one line broad, convolute, rarely flat, smooth below, scabrid above and on the margins.

Panicle linear, spike-like, usually interrupted or oblong and more or less lax, rigid or flaccid; branches single or 2-nate unequal, branched from the base or simple to the middle, erect or nodding or flexuous, filiform, scabrid, lateral pedicels short; spikelets 3-5 lines long, often purplish; glumes linear to linear-lanceolate, acute or subobtuse, 1-nerved, the lower 2-3½ lines, the upper 3-4½ lines long, sometimes mucronate; valve linear, laterally compressed, as long as the upper glume or slightly longer, rarely shorter, scabrid along the keel and the outer nerve, otherwise smooth or scabrid, particularly below the straight tip; callus ¼ line long; awns 6-9 lines long, rarely shorter (down to 4 lines) or longer (up to 1 inch), diverging, continuous with the valve, the lateral somewhat shorter; palea obtuse, less than ½ line long; lodicules similar to the palea, 3-5-nerved, ⅓-½ line long; anthers ½ line long. Grain almost as long as the valve.

*Fruits* :—January and March (Schweinf.).

*Locality* :—Above the coal-dépôts of the Messag. Marit. (Schweinf.); plain of Maala (Defl.); slope of Shum Shum Range at about 650 feet (Busse); rarissime (Hooker, Thomson).

*Distribution* :—Common in most dry and hot countries.

**2. *Aristida pumila*** Dene. Ann. Sc. Nat. (1835) p. 85; Steud. Syn. Pl. Gl. 138; Boiss. Fl. Or. V, 491; K. Krause in Engl. Bot. Jahrb. XXXV, 23.

*Aristida Adscensionis* var. *pumila* Coss. in Coss. & Durieu Expl. Sc. Alger. II, 84; Batt. et Trab. Fl. d'Alg. p. 56.

*Description* :—Annual, 1½-4 inches high; rootlets fibrous, pilose; culms several, filiform, striate, deflexed, glabrous, the nodes fuscous. Leaves setaceous, involute, acute, pale green, glaucescent, subarcuate; sheath split, striate, membranous on the margin; ligule ciliate.

Panicles subcontracted, subequal in length to the culms; spikelets 1-flowered, peduncled, scabrous. Lower glume linear, mucronate, aristate, upper one twice as long, linear, acute, glabrous. Flower shortly pedicelled; pedicel pilose. Lower palea linear, elongate, involute, subcarinate; the keel 3-nerved, the nerves passing into 3 filiform,

denticulate scabrous awns. Upper palæa very short, several times shorter than the lower one, included, ovate, obtuse, membranous. Stamens 3, erect, as long as the upper palea; anthers linear-oblong. Styles filiform, short; stigmas fibrillose, scarcely exceeding the stamens. Ovary ovate-oblong.

*Locality* :—Crater of Shum Shum Range (Defl.).

*Distribution* :—Nubia, Abyssinia, Central and S. Arabia, Morocco.

**3. *Aristida brachypoda*** Tausch in Flora 1836, p. 506; Boiss. Fl. Or. V, 495. K. Krause in Engl. Bot. Jahrb. XXXV, 23; Post Fl. Syr. Palest. and Sinai 860.

*Description* :—Cæspitose, 6-8 inches high. Leaves narrow-convolute, filiform, acute; culms erect or ascendent, often ramose in the lower part; sheaths glabrous; ligule reduced to a setaceous ring.

Panicle narrow, racemiform; glumes glabrous, narrowly linear-lanceolate, obtuse-acuminate; the upper one longer; callus long, hirsute, stipitiform; awn articulate,  $1\frac{1}{2}$  inches long. “*Aristâ infra genu brevissimâ rectâ nudâ, setâ mediâ tertiâ vel dimidiâ parte inferiore rarius a basi nudâ superne patule plumosâ, setis lateralibus tenuiter capillaribus nudis intermediâ dimidio vel tertiâ parte brevioribus ejus parte nudâ longioribus*” Boiss.

*Locality* :—Little Aden, on the Jebel Ishan (Defl.).

*Distribution* :—Upper Egypt, Sinai, S. Arabia.

*Note* :—“*Valde affinis facie A. plumosae a quâ vaginis glabris, aristæ parte infra genu sita brevioris setisque lateralibus magis elongatis fere tantum differt. An illae notae sat firmæ?*” Boiss. l.c.

**4. *Aristida paradisea*** Edgew. in Journ. As. Soc. Beng. XVI (1847), II, 1219.

*Arthratherum caloptylum* Jaub. et Spach Ill. Pl. Or. IV, t. 336.

*Aristida sericea* Ehrenb. Mss. ex Boiss.

*Aristida caloptyla* Boiss. Fl. Or. V, 497; K. Krause in Engl. Bot. Jahrb. XXXV, 23.

*Description* :—Almost 1 foot high, cæspitose. Leaves narrowly convolute, filiform, flexuose, acute; culms erect, glabrous, ramose at the base; sheaths glabrous.

Panicle erect, contracted, slightly lax, exerted from the uppermost sheath; glumes lanceolate, obtuse, attenuate-acuminate, the lower one longer; palea with a short long-plumose callus, much shorter than the glumes, with an articulate awn. “*Aristâ longâ infra genu elongatâ tortâ glabrâ, setis lateralibus tenuiter subulatis glabris intermediâ ex toto plumosâ triplo brevioribus.*”

*Fruits* :—November and March (Schweinf.).

*Locality* :—Plain of Maala (Defl.) ; Goldmore Valley, above the coal-depôt of the Messag. Marit., rocky and sandy watercourses (Schweinf.).

*Distribution* :—Egypt, Sinai, Arabia, Persia, Afghanistan.

*Note* :—" *Aristis elongatis affinis A. hirtiglumæ* sed glumæ. non hirtæ et inferior longitudine superiorem superans quod in aliis speciebus non occurrit." Boiss. l.c.

5. *Aristida hirtigluma* Steud. Nomen. Bot. ed. 2, I (1840) 131 et Syn. Pl. Glum. I, 144 ; Trin. & Rupr. in Mem. Acad. Petersb. ser. 6, V (1842) 171 ; Walp. Ann. Bot. III, 750 ; Boiss. Fl. Or. V, 496 ; Schweinf. Beitr. Fl. Aethiop. 298 ; Aitchis. Cat. Panj. Pl. 164 ; Duthie Grass. N. W. Ind. 26, Fodd. Grass. N. Ind. 47 ; Hook. Fl. Brit. Ind. VII, 227 ; Cooke, Fl. Bomb. Pres. II, 1009.

*Aristida ciliata* Steud. & Hochst. ex Steud. Nom. ed. 2, I, 131 (non Desf.).

*Aristida decorata* Steud. Syn. Gram. 421.

*Aristida pogonoptila* Boiss. Fl. Or. V, 496.

*Aristida Schimper* Hochst. & Steud. ex Steud. l.c. 143.

*Arthratherum ciliatum* Nees in Binnæ VII (1832) 287 ; Fl. Afr. Austr. I, 182.

*Arthratherum elatum* Boiss. Diag. Pl. Or. ser. 2, IV, 128.

*Arthratherum hirtiglume* Jaub. & Spach III. Pl. Or. IV, 52.

*Arthratherum pogonoptilum* Jaub. & Spach l.c. 56.

*Arthratherum Schimper* Nees. Fl. Afr. Austr. 178.

*Description* :—Perennial ; stems tufted, 1-2 feet high, smooth, glabrous, terete, shining ; nodes glabrous. Leaves 2-6 inches long, reaching  $\frac{1}{2}$  inch broad when opened out, convolute, filiform with capillary tips ; sheaths quite glabrous except for a few long hairs at the mouth, close ; ligule a very narrow densely ciliate membrane.

Panicle slender ; branches short, erect, capillary. Spikelets pale green or straw-coloured, linear-lanceolate. Lower involucreal glume  $\frac{1}{3}$  inch long, linear-oblong, acute, scarious ; upper involucreal glume a little longer, but similar ; floral glume slightly muricate ; callus about  $\frac{1}{10}$  inch long, pointed, shortly villous ; column of awn  $\frac{1}{10}$  -  $\frac{1}{8}$  inch long, plumose with long slender hairs articulated on the glume ; middle branch  $1\frac{1}{2}$  inches long or more, plumose in the lower half with long delicate hairs ; lateral branches very slender, hair-like, about  $\frac{1}{2}$  inch long, not plumose.

*Locality* :—Top of Shum Shum Range (Busse).

*Distribution* :—Tunis, Upper Egypt, Sinai, Syria, Nubia, Abyssinia, Eritrea, Highlands of Somaliland, Arabia, Sind, Punjab.

*Note*.—"Species glumis hirtis, flosculo muriculato, aristis longis ab *A. plumosa* et *brachypoda* facile distinguenda." Boiss. l.c.

**6. *Aristida plumosa*** Linn. Sp. Pl. ed. 2, p. 1666 ; Willd. Sp. Pl. I, 460 ; Vahl Symb. I, 11, t. 3 ; Trin. Diss. I, 181, II, 26 ; in Aët. Petrop. (1829) 89 ; Trin. & Rupr. in Mém. Acad. Pétersb. ser. 6, V (1842) 165 ; Kunth Enum. Pl. I, 195, II, 151 ; Steud. Syn. Pl. Glum. I, 143 ; Aitchis. Cat. Panj. Pl. 164 ; Boiss. Fl. Or. V, 495 ; Duthie Grass. N.W. Ind. 26, Fodd. Grass. N. Ind. 47 ; Hook. Fl. Brit. Ind. VII, 228 ; Durand & Schinz. Conspl. Fl. Afr. V, 807.

*Aristida lanata* Forsk. Fl. Aegypt.-Arab. 25.

*Aristida Raddiana* Savi in Mem. Moden. (1837), 198 ; Steud. l.c. 144.

*Arthratherum plumosum* Nees Fl. Afr. Austr. I, 182 ; Coss. & Durieu Expl. Scient. Algér. II, 81 ; Batt. et Trab. Fl. d'Alg. p. 56.

*Stipagrostis plumosa* Munro Mss. in Herb. Benth.; Anders. Journ. Linn. Soc. V, Suppl. p. 40.

*Description*.—Cæspitose, perennial ; stem 1-2 feet high, from a stout branching woody stock with stout rigid roots. Leaves 2-6 inches long, rigid, filiform, convolute, flexuous ; ligule reduced to a setose ring ; sheaths of leaves and internodes tomentellous or woolly.

Panicle 2-3 inches long (excl. the awns), narrow, racemiform. Spikelets erect ; glumes glabrous, unequal, lanceolate, acuminate, the upper longer ; lower palea one-third as long the glumes ; awn naked ; middle bristle  $\frac{1}{2}$  naked, the rest feathery, three to five times as long as the lateral bristles.

*Locality*.—Upper end of great valley between Steamer Point and town (Marchesetti) ; without locality (Edgew., Hook., Anders., Birdw.).

*Distribution*.—Morocco, Algeria, Tunis, Egypt, Abyssinia, Syria, Arabia, Kurdistan, Persia, Afghanistan, Western Tibet (7,700 feet).

**7. *Aristida mutabilis*** Trin. & Rupr. in Mém. Acad. Pétersb. Ser. VI, VII (1849) 150 (excl. var. *aequilonga*) ; Walp. Ann. Bot. III, 745 ; Steud. Syn. Pl. Glum. I, 141 ; Hook. f. Fl. Brit. Ind. VII, 226.

*Aristida articulata* Edgew. in Journ. Linn. Soc. VI (1862) 209 ; Aitch. Cat. Panj. Pl. 164 ; Duthie Grasses N. W. Ind. 26, Fodd. Grass. N. Ind. 47.

*Aristida Kunthiana* et *meccana* Trin. & Rupr. l.c. 151 (ex descr.) ; Steud. l.c. 141.

*Aristida Schweinfurthii* Boiss. Fl. Or. V, 493.

*Aristida spicata* Rottl. Mss. (ex Hooker f. l. c.).



*Aristida tenuis* Hochst. in Flora, XXVIII (1855) 200.

*Description* :—Stems 6-12 inches high, many ascending from the root, simple or proliferously branched, slender. Leaves 1-3 inches long, very slender, curved, convolute, rigid, smooth.

Panicles 3-6 inches long ; branches all very short and crowded, or with sometimes a few remote lower down or the stem ascending from a naked base and bearing a dense oblong fascicle of spikelets, rhachis smooth, branches scaberulous. Spikelets very shortly pedicelled, pale green or straw-coloured. Lower glume  $\frac{1}{8}$  inch, keel scaberulous ; upper glume  $\frac{1}{4}$  inch, tip 2-toothed below the awn ; valve scaberulous, callus shortly bearded ; column of awn nearly as long as the glumes, slender, smooth, branches capillary.

*Locality* :—Aden (Birdwood).

*Distribution* :—Senegal, Kordofan, Egypt, Arabia, Punjab, Rajpootana, Jodhpore, Southern India.

The Aden plant is a variety of the above species :

Var. *meccana* Fenzl. in Kotschy Pl. Aeth. n. 103. Glumes equal, florets  $3\frac{1}{2}$  lines long ; setæ 6-7 lines long.

### 9. *Sporobolus* R. Br.

Annuals or perennials of various habit ; ligules reduced to a ciliate or ciliolate rim. Panicles contracted to spike-like, or more or less open, sometimes extremely lax. Spikelets usually very small, continuous on the pedicels ; rhachilla more or less readily disarticulating above the glumes, or very rarely produced into a bristle. Floret 1, hermaphrodite. Glumes 2, delicately membranous, lower usually smaller, nerveless, upper 1-nerved, falling away one after the other. Valve more or less resembling the upper glume, 1-nerved or more or less distinctly 3-nerved. Palea usually almost as long as the valve, 2-nerved, folded between the nerves, often split by the maturing grain. Lodicules 2, small, broadly cuneate, glabrous, thin. Stamens 3, rarely 2. Ovary glabrous ; styles short, distinct, terminal ; stigmas plumose or subas-pergilliform.

Grain free, falling out or retained and dehiscing ; pericarp thin, usually swelling in water, rigid, dehiscing, or the inner layers mucilaginous when wetted and adherent, or the whole pericarp adnate and indistinct ; hilum small, punctiform, basal ; embryo rather large.

*Species* about 70.

*Distribution*:—Chiefly in the tropical and subtropical regions of both hemispheres.

Not more than  $1\frac{1}{2}$  feet high :

Lower involucrel glume as long as the floral glume or nearly so . . . 1. *S. glaucifolius*.

Lower involucrel glume shorter than upper involucrel and floral glume . . . . . 2. *S. spicatus*.

More than  $1\frac{1}{2}$  feet high . . . . . 3. *S. robustus*.

**1. *Sporobolus glaucifolius*** Hochst. in Flora XXV, part 1 (1842), Beibl. p. 133 ; Hook. Fl. Brit. Ind. VII, 250 ; Cooke Fl. Bomb. Pres. II, 1019.

*Vilfa glaucifolia* Steud. Syn. Gram. 154.

*Vilfa scabrifolia* Hochst. ex Edgew. in Journ. Linn. Soc. VI (1862), 196 ; Aitchis. Cat. Panj. Pl. 165.

*Agrostis barbata*  $\beta$  *senegalensis* Pers. Syn. I, 76.

*Agrostis littoralis*  $\beta$  Lamk. Illustr. 161 ; Poir. Encycl. Suppl. I, 251.

*Description* :—Perennial ; stems 12-18 inches long, densely tufted, leafy ; nodes glabrous. Leaves  $1\frac{1}{2}$ -5 by  $\frac{1}{10}$ - $\frac{1}{8}$  inch, narrowed from a subcordate base to an acuminate tip, strict, glaucous, flat or undulate, not pungent ; sheaths ribbed, glabrous ; ligule a line of hairs.

Panicle 3-5 inches long, contracted, interrupted, pale, yellowish-white ; branches short, erect. Spikelets crowded,  $\frac{1}{2}$  inch long ; pedicels very short. Glumes 3 ; lower involucrel glume  $\frac{1}{16}$  inch long, lanceolate, hyaline, acutely acuminate, 1-nerved ; upper involucrel glume  $\frac{1}{2}$  inch long, broader than the lower, ovate-lanceolate, acutely acuminate, hyaline, 1-nerved ; floral glume  $\frac{1}{16}$  inch long, ovate, acute, 1-nerved ; pales as long as the glume. Stamens 3 ; filaments very short ; anthers  $\frac{1}{10}$  inch long.

*Locality* :—Aden (Birdwood).

*Distribution* :—Tropical Africa, Punjab, Sind, W. Peninsula of India.

**2. *Sporobolus spicatus*** Kunth Revis. Gram. I ; Enum. Pl. I, 210 ; A. Rich. Tent. Fl. Abyss. II, 394 ; Boiss. Fl. Or. V, 512 ; Hook. Fl. Brit. Ind. VII, 250 ; Balfour f. Bot. Socotra 318 ; Durand & Barratte Fl. Lib. Prodr. (1910) 254.

*Sporobolus orientalis* Herb. Wight n. 3303, 3304, Cat. n. 1745 (partim).

*Vilfa spicata* Beauv. Agrost. 16 ; Trin. Diss. 1, 157, Sp. Gram. Ic. t. 12 ; Steud. Syn. Gram. 160.

*Agrostis spicata* Vahl. Symb. I, 9 ; Del. Fl. Aegypt. 20, t. 10, f. 1.

*Agrostis virginica* Forsk. Fl. Aegypt-Arab. 20 (ex Kunth).

*Arabic name* :—Elef (Schweinf.).

*Description* :—Stems 6-12 inches high, from a hard stoloniferous rootstock, stiff, strict above the geniculate base; leaves 1-2 inches long, divaricate, pungent, scabrid above; ligule 0.

Panicle spiciform, slender, cylindric, 2-3 inches by  $\frac{1}{16}$ - $\frac{1}{8}$  inch in diameter. Spikelets sessile,  $\frac{1}{8}$  inch long, persistent on the branchlets, pale. Glumes hyaline, lower involucre glume minute, rounded, upper involucre glume 1-nerved, lanceolate, acute; floral glume ovate-lanceolate; palea as long as the glumes.

Grain obliquely oblong or orbicular-oblong.

*Locality* :—Shaikh Othman (Defl.).

*Distribution* :—Tropical Africa, Egypt, Nubia, Abyssinia, Socotra, Arabia, Deccan.

3. *Sporobolus robustus* Kunth Rev. Gram. p. 425, t. 126 (1829-35) et Enum. Pl. I, 213, suppl. p. 168; Benth. in Hook. Niger Fl. 564 (1849); Schweinf. in Bull. Herb. Boiss. II, Append. 2, p. 28; Durand & Schinz Consp. Fl. Afr. V, 823; Rendle Cat. Afr. Pl. Welwitsch, II, pt. I, 206.

*Vilfa robusta* Steud. Syn. Pl. Glum. 154 (1854); Schweinf. Beitr. Fl. Aethiop. p. 303.

*Description* :—A fine widely caespitose grass, 2-6 feet high, culms ascending, geniculate, branched, nodes purplish, the lower sending out roots; sheaths usually slightly shorter than the internodes, thinly villous on the margins, subcoriaceous; ligule consisting of a narrow subciliate margin; leaves almost 1 foot long, 3 lines broad, flat, canaliculate-compressed, attenuate-linear or convolute-acuminate, glabrous, hispid on the margins.

Panicle almost one foot long, open, dense, consisting of racemes which bear flowers from the base; spikelets lanceolate, linear; glumes slightly hispid on the back, as long as the subequal valves.

*Locality* :—Aden (Birdwood).

*Distribution* :—Niger, Cape Verd Isles, Gaboon Coast, Abyssinia, Eritrea, Senegambia, Suakim.

### 10. *Eragrostis* Beauv.

Perennial or annual, of very varying habit; blades narrow; ligule reduced to a fringe of usually minute hairs.

Panicles lax to effuse or contracted to spike-like, or transformed into simple or compound spikes. Spikelets usually more or less olive-green or olive-grey, usually strongly laterally compressed, very rarely

articulate on the pedicels; rhachilla disarticulating above the glumes and between the valves or tough and persistent, glabrous, sometimes more or less scaberulous, very rarely minutely hairy. Florets 2 to many, hermaphrodite or the uppermost reduced. Glumes unequal or equal, usually membranous, 1-nerved, or the upper sometimes 3-nerved, keeled, persistent, or deciduous. Valves more or less imbricate, ovate to lanceolate, acute or obtuse, entire, muticous, membranous to chartaceous, 3-nerved, glabrous, very rarely minutely pubescent; side nerves short or almost percurrent. Palea equal to the valves or slightly shorter, membranous, 2-keeled, deciduous or persistent on the rhachilla. Lodicules 2, small, cuneate, more or less fleshy. Stamens 3, rarely 2. Ovary glabrous; styles distinct; stigmas plumose, laterally exserted.

Grain enclosed by the scarcely altered valve and palea and deciduous with them, or more commonly falling with the deciduous valve, leaving the more or less persistent palea behind, oblong to obovoid or globose, round or very obtusely triquetrous or quadrangular in cross section; pericarp thin, sometimes slightly swelling or separating; embryo often  $\frac{1}{2}$  as long as the grain; hilum punctiform, basal.

*Species* about 100.

*Distribution* :—Warm parts of the world.

Rhachilla of spikelets more or less jointed and breaking up from above downwards	. . . . .	1. <i>E. ciliaris</i> .
Rhachilla of spikelets tough, persistent	. . . . .	2. <i>E. major</i> .

1. *Eragrostis ciliaris* Link. Hort. Bot. Berol. I, 192; Trin. Gram. Gen. 397, et in Mém. Acad. Pétersb. ser. 6, I, 397; Nees Fl. Afr. Austr. 413; Steud. Syn. Pl. Glum. I, 265; Anderss. in Peters Reise Mossamb. Bot. 558; Anders. Journ. Linn. Soc. V, Suppl., p. 41; Baker Fl. Maurit. 456; Durand & Schinz Consp. Fl. Afr. V, 881; Hook. Fl. Brit. Ind. VII, 314; Cooke Fl. Bomb. Pres. II, 1023.

*Eragrostis lobata* Trin. in Mem. Acad. Petersb. ser. 6, I (1831) 396.

*Eragrostis lepida* Hochst. ex A. Rich. Tent. Fl. Abyss. II, 424.

*Eragrostis pulchella* Parl. in Hook. Niger Fl. 188.

*Poa ciliaris* Linn. Sp. Pl. 102; Jacq. Ic. Pl. Rar. II, t. 304; Kunth. Enum. I, 337; A. Rich. Ic. 423; Boiss. Fl. Or. V, 582.

*Megastachya ciliaris* Beauv. Agrost. 167; Roem. & Schult. Syst. II, 592.

*Description* :—Annual or subperennial (?), tufted; culms geniculate, ascending, often from a procumbent base, slender,  $\frac{1}{2}$ -2 feet long, glabrous, smooth, simple or branched below, about 3-noded, internodes exserted; sheaths striate, tight, glabrous or scantily hairy, bearded with long hairs at the mouth; ligule a fringe of short hairs; blades linear, tapering to

a fine point, 3-6 inches by 1-2 lines, usually involute, somewhat stiff and spreading, glabrous, or with scattered fine long hairs, scaberulous.

Panicle spike-like, more or less lobed or interrupted, dense to very dense, 2-6 inches long; axis scabrid; branches adpressed, usually all very short or the lowest up to 1 inch long, divided from the base; pedicels very short; spikelets crowded, ovate, strongly compressed, 1 to almost 2 lines long, loosely 6-12-flowered, pallid, sometimes purplish; rhachilla breaking up; glumes oblong-lanceolate, acute,  $\frac{2}{3}$  to almost  $\frac{1}{2}$  line long, 1-nerved, keel scabrid; valves oblong in profile, subtruncate and mucronulate, spreading, about  $\frac{1}{2}$  line long, thin, side-nerves prominent, keel scabrid; paleæ equal to the valves and falling with them; keels of palea very long and rigidly ciliate; anthers  $\frac{1}{3}$ - $\frac{1}{6}$  line long.

Grain elongate-ovoid,  $\frac{1}{4}$  line long, brown.

*Locality*:—Aden (Anders., Hildebrandt, Birdw.).

*Distribution*:—Common throughout tropical Africa and America, and in N. India.

*Note*:—This is an exceedingly variable plant. Anderson's specimens from Aden are only about  $1\frac{1}{2}$  inches high.

**2. *Eragrostis major*** Host. Gram. Austr. IV, 14, t. 22; Hook. Fl. Brit. Ind. VII, 320; Cooke Fl. Bomb. Pres. II, 1026; Trim. Fl. Ceyl. V, 297.

*Eragrostis flexuosa* Steud. Syn. Gram. 266; Duthie Grass. N. W. Ind. 37.

*Eragrostis megastachya* Hort. Berol. I, 187; Kunth. Enum. Pl. I, 333; Reichb. Ic. Fl. Germ. t. 91; Wight Cat. n. 1778; Thwaites Enum. Pl. Zeyl. 373; Trim. Cat. Ceyl. Pl. 109; Aitchis. Cat. Panj. Pl. 169; Duthie Grass. N. W. Ind. 38, Fodd. Grass. N. Ind. 63, t. 75; Lisboa in Journ. Bomb. Nat. Hist. Soc. VII (1893), 382; Ledeb. Fl. Ross. IV, 382; Boiss. Fl. Or. V, 580.

*Eragrostis multiflora* Aschers. ex Boiss. Fl. Or. V, 580.

*Eragrostis poaloides* Trin. in Mem. Acad. Petersb. ser. 6, I (1830) 404.

*Eragrostis vulgaris* var. *megastachya* Coss. & Dur. Fl. Alger. 148.

*Poa cilianensis* All. Fl. Pedem. II, 246, t. 91, f. 2.

*Poa elegans* Herb. Wight and Herb. Hamilt. ex Wall. Cat. n. 3828 C.D.

*Poa eragrostis* Cav. Ic. I, 63, t. 92; Sibth. Fl. Graec. t. 73.

*Poa flexuosa* Roxb. Fl. Ind. I, 339.

*Poa multiflora* Forsk. Fl. Aeg.-Arab. 21.

*Poa polymorpha* Koen. ex Wall. Cat. n. 3828 A.

*Poa Roxburghiana* Schult. Mant. II, 315.

*Poa subsecunda* Herb. Ham. ex Wall. Cat. n. 3828 D.

*Poa tortuosa* Spreng. Syst. Veg. I, 345.

*Megastachya Eragrostis* Beauv. Agrost. 74.

*Briza Eragrostis* Linn. Sp. Pl. 70; Schreb. Besch. Graes. II, 74.

*Briza oblonga* Moench. Meth. 185.

*Eragrostis* Wall. Cat. n. 3828, 3837.

*Description* :—Annual; stems 1-3 feet high, usually stout and branched, leafy, erect or geniculately ascending, smooth, polished. Leaves reaching 8 by  $\frac{1}{2}$  inch, narrowed to a fine point, flat, smooth, flaccid, glandular along the margins; sheaths sparingly bearded; ligule a ciliolate ridge.

Panicle 2-8 inches long, erect, oblong or ovate-oblong, open or sometimes contracted, usually stiff; rachis strict, rather stout, smooth; branches spreading or suberect, capillary, stiff or flexuose, again branching from near the base, the branchlets short, capillary. Spikelets  $\frac{1}{6}$ - $\frac{1}{4}$  inch long with 6-8 glumes, to linear oblong, rather narrowed upwards, and  $\frac{1}{3}$ - $\frac{1}{2}$  inch long or more with many (up to 60) glumes, olive grey or yellowish; rachilla tough, zigzag, the internodes short, smooth. Involucral glumes ovate, acute, with scabrid keels; lower smaller than the upper, 1-(sometimes 3-) nerved; upper slightly larger than the lower, 3-nerved; floral glumes broadly ovate, acute, sometimes apiculate,  $\frac{1}{12}$  inch long, strongly nerved; palea obovate, much curved, shorter than its glume, with ciliolate keels. Stamens 3; anthers  $\frac{1}{6}$  inch long.

Grain globose,  $\frac{1}{40}$  inch in diameter, microscopically rugulose, reddish-brown.

*Locality* :—Aden (Birdw.).

*Distribution* :—S. Europe, tropical and subtropical Asia, ascending to 5,200 feet in the Himalaya.

### 11. *Desmostachya* Stapf.<sup>1</sup>

Perennial, branched at the base; branches covered with leathery sheaths at or above the base and with a tuft of coarse leaves.

<sup>1</sup> Stapf. (in This.-Dyer Fl. Cap. VII, 632) has the following remark regarding this new genus: "The only species of this genus *D. bipinnata* Stapf, was originally described as *Uniola bipinnata* by Linnaeus. Subsequently it has been redescribed in, or referred to, at least 5 other genera, viz., *Poa*, *Briza*, *Cynosurus*, *Eragrostis* and *Leptochloa*. Hochstetter pointed out the affinity to the latter genus in Flora, 1855, 422. My recent researches in *Eragrostis* have convinced me that it is one of the links which connect *Eragrostes* and *Chlorideæ* (especially the *Leptochloa* group), and I have (following Sir Joseph Hooker's example in the case of *Myriostachys*) now separated *Desmostachya* generically from *Eragrostis*, where, under the name of *E. cynosuroides*, Beauv., it represented a separate section, *Desmostachya* in Hook. f. Fl. Brit. Ind."

Panicle spike-like, often interrupted below; branches (spikes) more or less spreading, irregularly approximate or spirally arranged on a stiff axis, persistent; spikelets on the lower side of, and often at right angles to the rhachis, closely packed, light straw-coloured or tinged with brown or purple, often very many-flowered. Spikelets linear, strongly laterally compressed, closely imbricate, alternate-sessile or subsessile on and falling entire from the slender rhachis of second more or less distinctly 2-ranked spikes which are crowded into long narrow spike-like panicles; rhachilla tough. Florets numerous, hermaphrodite, rather loose. Glumes very unequal, membranous, 1-nerved, keeled. Valves ovate, acute or subacute, entire, muticous, rigidly membranous, 3-nerved, acutely keeled, glabrous, side-nerves evanescent upwards. Palea slightly shorter than the valves, 2-keeled. Lodicules 2, rather large, asymmetric, hyaline, nerved at the base. Stamens 3. Ovary glabrous; styles distinct, slender; stigmas plumose, laterally exerted.

Grain loosely enclosed by the scarcely altered valve and palea, obliquely ovoid, obtusely triquetrous; pericarp thin, adnate to the seed; embryo about  $\frac{1}{3}$  the length of the grain, hilum small, basal, punctiform.

#### *Species 1.*

*Distribution* :— Syria, Mesopotamia, from Egypt southwards to East Tropical Africa and eastwards to India (from Peshawar and Sind to Burma and southward in hot and dry places).

#### **1. *Desmostachya bipinnata* Stapf. in This.-Dyer Fl. Cap. VII, 632.**

*Eragrostis cynosuroides* Beauv. Agrost. 71 (1812); Steud. Syn. Gram. 264; Wight Cat. n. 1774, 1774b.; Trin. in Mém. Acad. Pétersb. ser. 6, I (1831) 415; Dalz. & Gibs. Bomb. Fl. 298; Aitchis. Cat. Panj, Pl. 169; Duthie Grass. N. W. Ind. 37, Fodd. Grass. N. Ind. 62, t. 40; Boiss. Fl. Or. V, 583; Lisboa in Journ. Bomb. Nat. Hist. Soc. VII (1893) 387; Stapf in Hook. Fl. Brit. Ind. VII, 324; Woodr. in Journ. Bomb. Nat. Hist. Soc. XIII (1901) 441; Prain Beng. Pl. 1221; Watt. Dict. Econ. Prodr. III, 253; Cooke Fl. Bomb. Pres. II, 1029; Durand & Barratte Fl. Libyæ Prodr. (1910) 265.

*Poa cynosuroides* Retz. Obs. IV, 20; Roxb. Fl. Ind. I, 333; Del. Fl. Aegypt. 159, t. 10; Grah. Cat. Bomb. Pl. 236; Kunth Enum. Pl. I, 227.

*Leptochloa bipinnata* Hochst. in Flora XXXVIII (1855), 422.

*Briza bipinnata* Linn. Syst. Nat. X, 875.

*Cynosurus durus* Forsk. Fl. Aegypt.-Arab. 21.

*Dactylis interrupta* Herb. Rottl. (ex Stapf. in Fl. Brit. Ind.).

*Uniola bipinnata* Linn. Sp. Pl. ed. 2, 104.

*Eragrostis bipinnata* Muschler in Abhandl. d. bot. Vereins d. Prov. Brandenburg. vol. 40 (1907) 74.

*Eragrostis affine* Wall. Cat. n. 3821.

*Eragrostis eragrostoides* Wall. Cat. n. 5016.

*Characters* of the genus.

*Locality*:—Aden (Birdw.).

## 12. *Halopyrum* Stapf.

A tall stout perennial glabrous grass with a branching creeping sheathed rootstock. Leaves narrow, rigid, convolute.

Spikelets large, many-flowered, sessile or shortly pedicellate on the short alternate branches of an elongate panicle, ovoid, strongly laterally compressed, not joined on their pedicels, nor are the pedicels jointed on the branches; rhachilla articulate at the base and between the flowering glumes, silky hairy. Glumes many, closely distichously imbricate, dorsally rounded, coriaceous, keeled; involucrel glumes subequal, ovate-lanceolate, acuminate or apiculate; lower involucrel glume 1-3-nerved; upper involucrel glume 5-nerved; floral glumes 6-10, rather shorter than the involucrel, mucronulate, 3-nerved; palea as long as the glume, subacute, 2-keeled. Lodicules 2, obcordate. Stamens 3. Styles short, free; stigmas elongate.

Grain ellipsoid, compressed, deeply hollowed anticously, free.

*Species* 1.

*Distribution*:—Coasts of India and Ceylon, Arabia, Tropical Africa.

1. *Halopyrum mucronatum* Stapf in Hook. Ic. Pl. t. 2448 (1896); in Hook. Fl. Brit. Ind. VII, 328; Cooke Fl. Bomb. Pres. II, 1029.

*Brizopyrum mucronatum* Nees in Wall. Cat. Herb. Ind. n. 8898; Wight Cat. n. 2386.

*Desmazeria unioloides* Deff. Voy. Yemen 220.

*Eragrostis mucronata* Trim. Cat. Ceyl. Pl. 109 (non Roem. & Schult.).

*Eragrostis mucronata* (L.) Benth. & Hook. according to Krause in Engl. Bot. Jahrb. XXXV, 24.

*Uniola mucronata* Linn. Sp. Pl. ed. 2, 104; Kunth Enum. Pl. I, 425; Steud. Syn. Gram. 281.

*Triticum repens* Thw. Enum. Pl. Zeyl. 376.

*Aeluropus Aitchis*. Cat. Panj. Pl. 169.

*Eragrostis* sp. Sect. *Sclerostachya* Benth. & Hook. in Gen. Pl. III, 1187.



*Description*:—Rootstock sending up hard woody stems 12-18 inches high and as thick as a crow-quill, smooth, shining, with strict vermiform roots, the branches often fasciated and clothed at the base with pale coriaceous mucronate sheaths. Leaves 8-12 by  $\frac{1}{8}$ - $\frac{1}{8}$  inch, convolute (rarely flat), very narrow, glaucous, coriaceous, striate, quite smooth; sheaths terete, appressed, striate, hard with villous mouth; ligule a few hairs.

Panicle 12-16 inches long, erect or nodding; rhachis and branches quite smooth, angular, wiry. Spikelets  $\frac{1}{2}$ - $\frac{5}{8}$  inch long, flat, sessile or shortly pedicellate, 10-15-flowered, smooth, white or pale-yellowish; rhachilla very short, the hairs half as long as the glumes. Lower involucre glume  $\frac{1}{4}$  inch long, scarcely longer than the lowest flowering glume, ovate-lanceolate, apiculate; upper involucre glume  $\frac{1}{2}$  inch long, strongly 5-nerved.

*Flowers and fruits* in December (Schweinf.).

*Locality*:—Eastern shore of the isthmus north of Barrière Gate on small dunes and sandhills forming large bushes with stolons often reaching 3 feet and more (Schweinf.); without locality (Defl., Birdw.).

*Distribution*:—S. Arabia, N. India.

### 13. *Cynodon Pers.*

Perennial glabrous grasses; stems creeping, rooting at the nodes and arising from the fascicles of barren shoots and flowering stems.

Spikes 2-6, in terminal umbels. Spikelets 1-flowered, laterally compressed, sessile, imbricate, alternately 2-seriate and unilateral on a slender keeled rhachis; rhachilla disarticulating above the involucre glumes, produced or not beyond the floral glume. Floret hermaphrodite. Involucre glumes narrow, keeled, acute or subulate-mucronate, the upper usually deciduous with the floral glume, the lower subsistent; floral glume exceeding the involucre glumes, navicular, firmly membranous, 3-nerved, awnless, the keel ciliate; palea somewhat shorter than the glume, 2-keeled. Lodicules 2, minute, obovate-cuneate, glabrous. Stamens 3. Ovary glabrous; styles distinct, slightly shorter than the plumose stigmas.

Grain oblong, subterete, free within the glumes.

*Species* 2.

*Distribution*:—One species in S. Africa, the other almost cosmopolitan.

1. *Cynodon dactylon Pers.* Syn. I, 85; Kunth Enum. Pl. I, 259, Suppl. 203, t. 16, f. 1; Reichb. Ic. Fl. Germ. t. 26, f. 1404; Wall.

Cat. n. 3803; Dalz. & Gibs. Bomb. Fl. 297; Griff. Notul. III, 50, Ic. Pl. Asiat. t. 139, f. 204; Thwaites Enum. Pl. Zeyl. 371; Trim. Cat. Ceyl. Pl. 109; Aitchis. Cat. Panj. Pl. 160; Duthie Grass. N.-W. Ind. 32, Fodd. Grass. N. Ind. 52; Lisboa in Journ. Bomb. Nat. Hist. Soc. VII (1893) 366; Benth. Fl. Hongk. 428, Fl. Austral. VII, 609; Hook. Fl. Brit. Ind. VII, 288; Cooke Fl. Bomb. Pres. II, 1032; Nees Fl. Afr. Austral. 241; Steud. Syn. Pl. Glum. I, 212; Engl. Hochgebirgsfl. Trop. Afr. 132; Durand & Schinz Consp. Fl. Afr. V, 856; Engl. Pfl. Ost. Afr. A. 11, 79; B. 78; C. 110; Stapf. in This.-Dyer Fl. Cap. VII, 634.

*Cynodon erectus* Presl Rel. Haenk. I, 290; Kunth Enum. Pl. I, 260.

*Cynodon filiformis* Voigt Hort. Suburb. Cal. 712.

*Cynodon linearis* Willd. Enum. Hort. Berol. 90; Wight Cat. n. 1750.

*Cynodon maritimus* H. B. and K. Nov. Gen. et Spec. I, 170.

*Cynodon occidentalis* Willd. ex Steud. Nom. ed. 2, I, 463.

*Cynodon portoricensis* Willd. ex Steud. l. c.

*Cynodon radiatus* Roth. Nov. Pl. Sp. 38; Kunth Enum. Pl. I, 260.

*Cynodon repens* Dulac. Fl. Haut. Pyr. 76.

*Cynodon sarmentosus* S. F. Gray Nat. Arr. Brit. Pl. II, 100.

*Cynodon stellatus* Willd. Enum. Hort. Berol. 90; Kunth Enum. Pl. I, 260.

*Cynodon virgatus* Nees ex Steud. Syn. Gram. 213.

*Cynodon pascuus* Nees. Agrost. Bras. 425; Kunth Enum. Pl. I, 259; Nees Fl. Afr. Austr. 243; Steud. Syn. Pl. Glum. I, 212; Durand & Schinz Consp. Fl. Afr. V, 857.

*Cynodon glabratus* Steud. Syn. Pl. Glum. I, 212; Durand & Schinz Consp. Fl. Afr. V, 857.

*Chloris Cynodon* Trin. Gram. Unifl. 229.

*Chloris maritima* Trin. l. c. 226.

*Fibichia umbellata* Koel. Gram. Gall. et Germ. 308.

*Dactylon officinale* Vill. Hist. Pl. Dauph. II, 69.

*Digitaria Dactylon* Scop. Fl. Carn. ed. 2, I, 52.

*Digitaria littoralis* Salisb. Prodr. 19.

*Digitaria maritima* Spreng. Syst. I, 272.

*Digitaria radiata* Spreng. l. c. 272.

*Digitaria stolonifera* Schrad. Fl. Germ. I, 165, t. 3, f. 9; Steud. in Flora (1829) II, 468.

*Panicum dactylon* Linn. Sp. Pl. 58; Thunb. Prodr. I, 19; Fl. Cap. ed. Schult. 103; Host. Gram. Austr. II, 15, t. 18; Sibth. Fl.

Graec. 45, t. 60; Engl. Bot. t. 840; Knapp Gram. Brit. t. 13;  
Grah. Cat. Bomb. Pl. 236; Roxb. Fl. Ind. I, 289.

*Panicum lineare* Burm. Fl. Ind. 25, t. 10, f. 2.

*Paspalum dactylon* DC. Fl. Franc. III, 16.

*Paspalum praecox* Walt. Fl. Carol. 75.

*Paspalum umbellatum* Lam. Illustr. I, 177.

*Agrostis bermudiana* Tussac ex Kunth l. c. 259.

*Agrostis filiformis* Koen. ex Kunth l. c. 261.

*Agrostis linearis* Retz. Obs. IV, 19.

*Agrostis stellata* Willd. Sp. Pl. I, 376.

*Names* :—Creeping Panic Grass, Bermuda Grass.

*Description* :—Culms from a few inches to 1 foot long, slender, glabrous, smooth, many-noded, the lower internodes very short, enclosed, the upper 3-4 much longer, more or less exerted; leaves usually conspicuously distichous on the barren shoots and at the base of the culms; sheaths tight, glabrous or hairy, often bearded at the mouth; ligule a very fine ciliate rim; blades linear, finely acute to pungent,  $1\frac{1}{2}$ -6 inches by  $1$ - $1\frac{1}{2}$  lines, very rigid to flaccid, folded or convolute or flat, more or less glabrous or hairy, smooth below, scaberulous above.

Spikes 2-6, straight,  $\frac{1}{2}$ - $2\frac{1}{2}$  inches long; rhachis pubescent at the base, keel and margins scabrid or the keel smooth; spikelets light green or purplish,  $\frac{7}{8}$ - $1\frac{1}{2}$  lines long; rhachilla produced, very slender, equalling  $\frac{1}{2}$  the length of the spikelet; glumes lanceolate, acute to subulate-mucronate, the lower  $\frac{1}{2}$ - $\frac{3}{4}$  lines long, the upper usually slightly longer, keels scabrid or smooth; valve obliquely oblong to semi-ovate, subobtusate or minutely apiculate, about 1 line long, keel ciliate; keels of palea scaberulous; anthers oblong,  $\frac{1}{2}$  inch long. Grain  $\frac{1}{2}$  line long.

*Locality* :—Aden (Birdw.).

*Distribution* :—Almost cosmopolitan.

*Uses* :—Having great fattening and milk-producing qualities this plant is a very valuable fodder grass. The plant is also used medicinally and a cooling drink is said to be prepared from the roots.

#### 14. *Chloris* Sw.

Annual or perennial grasses. Leaves flat or convolute.

Spikes solitary or several, in terminal umbels or short racemes, erect or stellately spreading. Spikelets of 2-4 florets (1 only or rarely more fertile), sessile, crowded, unilateral, 2-seriate on a slender rhachis; rhachilla disarticulating above the involucreal glumes, more or less

produced; lowest floret hermaphrodite, the second male or barren (rarely fertile), the following if present barren, often minute. Involucral glumes 2, persistent, narrow, keeled, membranous, 1-nerved, acute, mucronate or the upper awned. Hermaphrodite floret: floral glume narrow or broad, 3-nerved, acute or obtuse, minutely 2-toothed, usually awned from below the apex, often ciliate; palea almost equalling the glume, 2-keeled. Lodicules 2, minute. Stamens 3. Ovary glabrous; styles distinct, short; stigmas laterally exerted. Male floret: glume and palea as in the hermaphrodite flower, but smaller and glabrous. Rudimentary florets glabrous, awned or awnless, small to minute, usually without a trace of a pale.

*Species* between 40 and 50.

*Distribution*:—Tropical and subtropical regions of both hemispheres.

1. *Chloris villosa* Pers. Syn. I, 87; Kunth Enum. Pl. I, 267, Suppl. 217, t. 16, f. 3; Jaub. & Spach Ill. Pl. Or. IV, 40, t. 327; Coss. & Dur. Fl. Alger. 87; Steud. Syn. Pl. Glum. I, 204; Aitchis. Cat. Panj. Pl. 167; Schweinf. Beitr. Fl. Aethiop. 298; Aschers. & Schweinf. Ill. Fl. d'Eg. 170; Hook. Fl. Brit. Ind. VII, 291; Cooke Fl. Bomb. Pres. II, 1034.

*Chloris tetrapogon* Beauv. Agrost. 158.

*Tetrapogon villosus* Desf. Fl. Atlant. II, 388, t. 255; Anders. Journ. Linn. Soc. V, Suppl. p. 40; Trin. Fund. Agrost. 760; Boiss. Fl. Or. V, 555; Duthie Grass. N. W. Ind. 33; Fodd. Grass. N. Ind. 55, t. 68; Krause in Engl. Bot. Jahrb. XXXV, 24; Blatter in Journ. Bomb. Nat. Hist. Soc. XVII, 920.

*Description*:—Perennial, stout; stems 6-10 inches long from a densely tufted stout woody base, clothed with equitant leaf-sheaths. Leaves 1-3 by  $\frac{1}{16}$ – $\frac{1}{10}$  inch, linear, acute, flat, convolute or twisted, rigid; ligule obscure.

Spikes 1-3, erect, pale-yellow,  $1\frac{1}{2}$ – $2\frac{1}{2}$  by  $\frac{1}{3}$ – $\frac{1}{2}$  inch. Spikelets  $\frac{1}{3}$  inch long, obconic, with 4 unequal awns. Glumes 6; lower involucral glume  $\frac{1}{3}$  inch long (including a short awn), oblong-lanceolate, hyaline; upper involucral glume  $\frac{1}{3}$  inch long, oblong, hyaline, 2-toothed at the tip and shortly awned; glume of the hermaphrodite floret  $\frac{1}{3}$  inch long; broadly ovate or suborbicular, concave, with an awn  $\frac{1}{4}$  inch long or more, and broad hyaline margins bounded by the lateral nerves, hirsute all over with long silky hairs which are much longer than the glume; the palea elliptic-obovate with ciliate margins, hyaline; the 4th glume barren, about  $\frac{1}{2}$  as long, also hirsute, the 5th small, cuneate, the 6th reduced to an awn.

*Locality*:—Above the coal-depôts of the Messag. Marit. (Schweinf.); Flag-staff on top of the Shum Shum Range and in a valley south-west of the Tower of Silence (Defl.); top of Shum Shum Range (Busse); without locality (Hooker, Thomson).

*Distribution*:—Canaries, Morocco, Algeria, Egypt, Abyssinia, Eritrea, S. Arabia, S. Persia, Sind, Punjab, Rajputana.

### 15. *Eleusine Gaertn.*

Annual or perennial; leaves long, flat or folded, flaccid or firm.

Spikelets, 3-12-flowered (flowers all perfect except the terminal), sessile, 2-3-seriate and secund, forming digitate capitate or whorled spikes laterally compressed, not jointed at the base. Rhachilla disarticulating above the glumes and between the valves, or tough, produced, sometimes terminating with a rudimentary valve. Florets hermaphrodite. Glumes 2, subequal, persistent, obtuse or obscurely mucronate, membranous, strongly keeled, 3-5-nerved, the lateral nerves close to the keel, the lower shorter, with the keel crested. Valves very similar, 3-nerved near the base; lateral nerves submarginal above, with 1-2 short additional nerves, close to the keel. Paleæ slightly shorter than the valves, 2-keeled, keels winged. Lodicules 2, minute, cuneate, Stamens 3. Ovary glabrous, styles slender from a broadened base, distinct; stigmas plumose, laterally exserted.

Grain broadly-oblong to globose, broadly grooved; pericarp loose, delicate, breaking up irregularly or almost circumscissile; seed finely striate; embryo suborbicular, basal; hilum punctiform, basal.

*Species* about 7.

*Distribution*:—Tropical Africa and Asia; one widely spread through the tropics.

1. *Eleusine aegyptiaca* Desf. Fl. Atlant. I, 85; Graham Cat. Bomb. Pl. 235; Roxb. Fl. Ind. I, 344; Wall. Cat. n. 3818; Griff. Notul. III, 51, Ic. Pl. Asiat. t. 139, f. 79; Trim. Cat. Ceyl. Pl. 109; Benth. Fl. Austral. VII, 615; Duthie Grass. N. W. Ind. 34; Fodd. Grass. N. Ind. 56, t. 35; Lisboa in Journ. Bomb. Nat. Hist. Soc. VII (1893), 374; Prain Beng. Pl. 1229; Hook Fl. Brit. Ind. VII, 295; Cooke Fl. Bomb. Pres. II, 1038.

*Eleusine ciliata* Rafin. in Desv. Journ. Bot. IV (1814), 273.

*Eleusine cruciata* Lamk. Illustr. I, 203, t. 48, f. 2.

*Eleusine mucronata* Stokes Mat. Med. I, 150; Lisboa in Journ. Bomb. Nat. Hist. Soc. VII (1893), 376.

*Eleusine pectinata* Moench Meth. Suppl. 68.

*Eleusine prostrata* Spreng. Syst. I, 350.

*Eleusine radulans* Br. Prodr. 186.

*Dactyloctenium aegyptiacum* Willd. Enum. Pl. Hort. Berol. 1029 ; Beauv. Agrost. 72, t. XV, f. 2 ; Kunth Enum. Pl. I, 261, Suppl. II, 204 ; A. Rich. Tent. Fl. Abyss. II, 406 ; Steud. Syn. Pl. Glum. I, 211 ; Grah. Cat. Bomb. Pl. 235 ; Dalz. & Gibs. Bomb. Fl. 297 ; Thw. Enum. Pl. Zeyl. 371 ; Aitchis. Cat. Panj. Pl. 167 ; Miq. Fl. Ind. Bat. III, 384 ; Anders. Journ. Linn. Soc. V, Suppl. p. 41 ; Boiss. Fl. Or. V, 556 ; Griseb. Fl. Brit. W. Ind. 540 ; Baker Fl. Maurit. 452 ; Schweinf. in Bull. Herb. Boiss. II, Append. II, 34 ; Durand & Schinz Conspect. Fl. Afr. V, 868 ; Hal. Consp. Fl. Graec. III, 337 ; Coss. & Dur. Fl. Alg. Glum. 85 ; Batt. & Trab. Fl. Alg. II, 188 ; Stapf. in This.-Dyer Fl. Cap. VII, 646 ; Krause in Engl. Bot. Jahrb. XXXV, 25 ; Durand & Barr. Fl. Libyc. Prodr. (1910), 261.

*Dactyloctenium distachyum* Bojer Hort. Maurit. 370.

*Dactyloctenium Figarei* De Not. Catal. Sem. Hort. Genuens. 1847, and in Ann. Sc. Nat. ser. 3, IX (1848), 325 ; Steud. l. c.

*Dactyloctenium meridionale* Ham. Prodr. Pl. Ind. Occ. 6.

*Dactyloctenium mucronatum* Willd. Enum. Pl. Hort. Berol. 1029 ; Trin. Sp. Gram. Ic. t. 69 ; Nees Fl. Afr. Austral. 150 ; Steud. Syn. Pl. Glum. 212 ; Anderss. in Peters Reise Mossamb. Bot. 555 ; Wight Cat. n. 1761.

*Dactyloctenium prostratum* Willd. l. c. ; Steud. l. c.

*Dactyloctenium radulans* Beauv. Agrost. 72 ; Kunth l. l. c. c. 262, 204 ; Steud. l. c.

*Cynosurus aegyptius* Linn. Sp. Pl. 72.

*Cynosurus Cavara* Herb. Ham. ex Wall. Cat. l. c. B.

*Cynosurus Macara* Herb. Ham. l. c. C.

*Cynosurus distachyus* Rottl. ex Steud. Nom. ed. 2, I, 465.

*Chloris mucronata* Mich. Fl. Am. Bor. I, 59.

*Cenchrus aegyptius* Beauv. Agrost. 157.

*Rhabdochloa mucronata* Beauv. Agrost. 84.

*Aegilops saccharinus* Walt. Fl. Carol. I, 249.

*Arabic name* :—Areija.

*Description* :—Annual of variable habit, 1-1½-feet high ; stems sometimes prostrate, rooting from the proliferously branched nodes, geniculately ascending, compressed, glabrous smooth. Leaves linear, 1-5 by  $\frac{1}{12}$ - $\frac{1}{8}$  inch, tapering to a fine point, flat, glaucous, glabrous or hairy or hispidly ciliate with bulbous-based hairs ; ligule a slightly ciliate line.

Spikes 2-6, digitately radiating,  $\frac{1}{2}$ -1½-inches long ; rachis trigonous or dorsally flattened, rigid, often excurrent into a pungent

mucro. Spikelets many, 3-5-flowered, spreading at right angles to the rachis, up to  $\frac{1}{8}$  inch long. Glumes divaricate; lower involucre glume ovate, acute,  $\frac{1}{12}$  inch long; upper involucre glume  $\frac{1}{12}$  inch long (excluding the awn), suborbicular, the midnerve produced into a usually curved awn often as long as or sometimes longer than the glume; floral glumes gibbously ovate, up to  $\frac{1}{8}$ -inch long, mucronate or awned; palea rather shorter than its glume, ovate-oblong, obtuse or 2-fid. Anthers about  $\frac{1}{20}$ -inch long.

Grain subglobose, reddish, very rugose,  $\frac{1}{25}$ -inch in diameter.

*Locality* :—Flag-staff on top of Shum Shum Range, Goldmore Valley (Defl.); great valley between Steamer Point and town (Marchesetti); without locality (Hooker, Thomson).

*Distribution* :—Widely spread throughout tropical and subtropical regions (Tunis, Algeria, S. Italy, Sicily, Greece, Syria, Arabia, Egypt, Nubia, Abyssinia, Sind, Deccan, Konkan, etc.)

## 16. *Enneapogon Desv.*

Perennial, rarely subannual; blades usually narrow, often convolute; ligules reduced to a line of hairs.

Panicle contracted, more or less spike-like, elegantly bristly-plumose from the numerous awns. Spikelets 3-flowered; rachilla disarticulating above the glumes, minutely scaberulous or almost smooth. Lowest floret hermaphrodite, the intermediate male or barren, the uppermost rudimentary, minute. Glumes 2, persistent, membranous, acute or obtuse or minutely truncate, 3-5 or sub-7-nerved. Hermaphrodite floret: valve very broad, rounded on the back, rather firm, more or less villous, 9-nerved, 9-awned; awns subulate, equal or subequal, plumose, ciliate or scaberulous; callus minute, short, pale oblong, 2-keeled, exceeding the valve; lodicules 2, minute, cuneate, fleshy; stamens 3; ovary glabrous; styles distinct, short; stigmas laterally exerted, loosely plumose. Second floret like the lower, but the valve about  $\frac{1}{2}$  as long, glabrous, the ovary rudimentary or suppressed. Uppermost floret reduced to a tuft of minute awns.

Grain oblong, dorsally more or less compressed; hilum punctiform, subbasal; embryo large, occupying  $\frac{3}{4}$  or more of the front.

*Species* about 6.

*Distribution* :—In the dry and warm regions of the Old World and in Australia, one in Western North America.

1. *Enneapogon brachystachyus* Stapf in This.-Dyer Fl. Cap. VII, 654.

*Pappophorum phleoides* Trin. in Spreng. Neue Entdeck. II, 73; Gram. Gen. 91, et in Mém. Acad. Pétersb. ser. 6, I (1831), 91; Kunth Enum. I, 254 (non Cav. neque Steud.).

*Pappophorum brachystachyum* Jaub. & Spach in Ann. Sc. Nat. ser. 3, XIV (1850), 365; Illustr. Pl. Or. IV, 34; Steud. Syn. Pl. Glum. I, 200; Durand & Schinz Consp. Fl. Afr. V, 870; Boiss. Fl. Or. V, 558; Hook. Fl. Brit. Ind. VII, 302; Blatter in Journ. Bomb. Nat. Hist. Soc. XVII (1907), 920.

*Pappophorum figarianum* Fig. & De Not. in Mem. Ac. Torin. ser. 2, XII (1852), 254.

*Pappophorum bulbosum* Fig. & De Not. l. c.

*Pappophorum vincentianum* Schmidt Beitr. Fl. Cap. Verd. Ins. 144; Durand & Schinz l. c. 871.

*Pappophorum nanum* Steud. l. c.; Edgew. in Journ. Linn. Soc. VI (1862), 196.

*Pappophorum senegalense* Steud. l. c.; Durand & Schinz l. c. 871.

*Description*.—Perennial, often compactly caespitose, all parts finely glandular pubescent, rarely subglabrous; culms fascicled, geniculately ascending, 2-6 inches long, slender, often with a bulbous thickening at the base, 2-4-noded, simple or sparingly branched below, internodes mostly exserted; leaves mostly near the base; sheaths tight or those at the base of the branches loose, finely striate, nodes pubescent to villous; blades very narrow, linear, finely attenuated, 1-5 inches long, usually setaceously convolute, sometimes more or less scabrid.

Panicle spike-like,  $\frac{1}{2}$ -1 $\frac{1}{2}$  inches by 3-5 lines, dense, light to dark grey; spikelets 1 $\frac{3}{4}$ -2 lines long; glumes subequal, oblong, obtuse or emarginate, scantily pubescent, thin, usually 5-(rarely 3- or 7-) nerved, side-nerves evanescent above; lower valve  $\frac{3}{4}$  line long, shortly villous; awns about 1-1 $\frac{1}{2}$ -lines long, shortly plumose to or beyond the middle; palea 1 line long, keels scabrid; anthers ellipsoid-oblong,  $\frac{1}{8}$ - $\frac{1}{6}$  line long. Grain almost  $\frac{1}{2}$  line long.

*Locality*.—Aden (Birdw.).

*Distribution*.—South Africa, Kalahari Region, Senegambia, Cape Verde, North Africa, Arabia, Panjab, Rajputana, Central Asia.

### 17. *Aeluropus* Trin.

Low, much-branched, very rigid perennial leafy grasses. Leaves distichous, short, strict, usually convolute, coriaceous, pungent.

Spikelets 6-many-flowered, minute, sessile, densely crowded in terminal villous heads, laterally compressed, not articulate at the base; rachilla obscurely jointed at the base, not produced beyond the upper



glume; internodes very short. Glumes many, oblong, membranous, apiculate, the margins and tips broadly hyaline. Involucral glumes unequal, persistent, lower one narrowly oblong, 1-3-nerved, upper one much larger, 5-7-nerved from below the hyaline tip; floral glumes oblong, apiculate, 7-9-nerved; palea very large, broadly cuneate, 3-lobed, the lobes erose, flaps broad, keels nearly smooth or ciliolate. Lodicules obliquely truncate. Stamens 3; anthers minute. Styles short, free; stigmas short, plumose. Grain oblong or obovoid, free within the glumes.

*Species few.*

*Distribution*:—From the Mediterranean and Caspian regions to the Punjab, Sind, S. India and Ceylon.

Spikelets 4-8-flowered	.	.	.	.	.	1. <i>A. villosus</i> .
Spikelets 9-12-flowered	.	.	.	.	.	2. <i>A. littoralis</i> .

**1. *Aeluropus villosus* Trin. ex C. A. Mey. Verz. Pfl. Cauc. 18;** Aitchis. Cat. Panj. Pl. 169; Hook. Fl. Brit. Ind. VII, 334; Trim. Fl. Ceyl. V, 304; Woodr. in Journ. Bomb. Nat. Hist. Soc. XIII (1901), 441; Cooke Fl. Bomb. Pres. II, 1045.

*Aeluropus arabicus* Steud. Nomencl. Bot. ed. 2, I, 30; Anders. Journ. Linn. Soc. V, Suppl. p. 42; Boiss. Fl. Or. V, 595.

*Aeluropus brevifolius* Wall. Cat. n. 8897; Wight Cat. n. 1792 (non Herb. Wight et excl. syn. *Dactylis brevifolia*, Linn.); Duthie Grass. N. W. Ind. 39.

*Aeluropus brevifolius* Nees in Steud. Nomencl. Bot. ed. 2, I, 30; Aschers. & Schweinf. Ill. Fl. d'Eg. 173.

*Aeluropus concinnus* Fig. & de Not. in Mem. Acad. Torin. ser. 2, XII (1852), 257.

*Aeluropus siniacus* Fig. & de Not. l. c.

*Aeluropus lagopodioides* Trin. ex Tw. Enum. Pl. Zeyl. 374.

*Aeluropus lagopoides* Trin. ex Trim. Cat. Ceyl. Pl. 110.

*Aeluropus littoralis* var. *repens* Coss. & Dur. Expl. Sc. Alger. 155; Boiss. Fl. Or. V, 594.

*Aeluropus mucronatus* Aschers. in Schweinf. Beitr. Fl. Aethiop. 297; Boiss. l. c. 595.

*Aeluropus niliacus* Steud. Nomencl. Bot. ed. 2, I, 30.

*Aeluropus niloticus* Edgew. in Journ. Linn. Soc. VI (1862), 196.

*Aeluropus pubescens* Trin. ex Steud. l. c. partim?

*Aeluropus pungens* C. Koch in Linnæa XXI (1848), 408.

*Aeluropus repens* Parl. Fl. Ital. I, 462; Edgew. l. c.

*Aeluropus bombycinus* Fig. & de Not. in Mem. Acad. Torin. ser. 2, XII (1852), 258.

*Dactylis lagopodioides* Dalz. and Gibs. Bomb. Fl. 298 (excl. syn.).  
*Dactylis lagopoides* Linn. Mant. 38; Roxb. Fl. Ind. I, 340; Grah. Cat. Bomb. Pl. 236 (excl. Syn.).

*Dactylis massaviensis* Steud. Syn. Gram. 298.

*Dactylis repens* Desf. Fl. Atlant. I, 79, t. 15.

*Poa lagopodioides* Kunth Rev. Gram. I, 111; Enum. I, 325.

*Poa massavensis* Fresen. in Mus. Senckenb. II (1837), 143.

*Poa repens* Bieb. Fl. Taur. Cauc. III, 69.

*Poa tunetana* Spreng. Pugill. II, 20.

*Calotheca arabica*

*Calotheca niliaca* } Spreng. Syst. Veg. I, 347, 348.

*Calotheca repens* }

*Koeleria brevifolia* Herb. Wight ex Wall. Cat. n. 8897 C.

*Sesleria lagopodioides* Spreng. Pugill. II, 22.

*Festuca mucronata* Forsk. Fl. Aegypt. Arab. 22.

*Festuca pungens* Vahl Symb. I, 10, t. 2.

*Description*:—Perennial, rigid, tufted; stems 3-8-inches long, crowded on a woody rootstock with stout root-fibres, as thick as a crow-quill, simple or branched, smooth and polished; branches sometimes elongate, divaricate, 6-10 inches long, resembling stolons, giving off branchlets at the nodes but not rooting; nodes glabrous; internodes short or long. Leaves  $\frac{1}{8}$ -1 inch long, narrowly lanceolate, acuminate, flat or convolute and subulate, erect or spreading, glabrous or sparsely ciliate; sheaths short, terete or inflated, glabrous or ciliate; ligule a shortly hairy ridge.

Heads of spikelets shortly pedunculate, subglobose or oblong. Spikelets reaching  $\frac{1}{8}$ -inch long, 4-8-flowered, crowded, sessile, villous with soft hairs, pale green or white. Lower involucreal glume  $\frac{1}{10}$ -inch long, ovate-oblong, subacute, hairy and with ciliate margins; upper involucreal glume  $\frac{1}{8}$ -inch long, similar; floral glumes  $\frac{1}{8}$ -inch long, ovate, subobtusate, apiculate, many-nerved, hairy and ciliate, the lower 2-4 sometimes neuter; pale, broad, 3-lobed. Anthers  $\frac{1}{16}$ -inch long, oblong.

Grain  $\frac{1}{10}$ -inch long, obovoid-oblong, dorsally compressed.

*Flowers and fruits*:—December (Schweinf.).

*Locality*:—In sandy places (Anders.); Shaikh Othman (Defl.); very common on sand fields along the coast of Shaikh Othman (Schweinf.).

*Distribution*:—Mediterranean and Caspian regions, Upper Egypt, Nubia, Central and S. Arabia, Persia, Afghanistan, Sind, Punjab, W. Peninsula of India, Ceylon.

2. *Aeluropus littoralis* Parl. Fl. Ital. I, 461; Batt. & Trab. Fl. d'Alg. 75; Boiss. Fl. Or. V, 591; Pojero Fl. Sic. (1909), 332.

*Dactylis littoralis* Willd. Sp. Pl. I, pars 1, 408; Roem. & Schult. Syst. Veg. II, 628; Bert. Amœn. Ital. 238; Pollin. Fl. Veron. I, 116; Tent. Fl. Nap. III, 72; Guss. Pl. Rar. 30, et Fl. Sic. Prodr. I, 100 (excl. syn. Cup. et Bon.); Lois. Fl. Gall. ed. 2, I, 69; Boiss. Voy. en Esp. 664; Vis. Fl. Dalm. I, 77; Guss. Fl. Sic. Syn. I, 91; *Poa littoralis* Gouan Fl. Monsp. 470; Savi Bot. Etrusc. II, 53; Moric. Fl. Venet. I, 52; Nacc. Fl. Venet. I, 70; Kunth Enum. Pl. I, 324 (excl. Syn. Desf.).

*Dactylis maritima* Schrad. Fl. Germ. I, 313; Roem. & Schult. Syst. Veg. II, 627; Reich. Fl. Germ. Excurs. I, 36.

*Festuca littoralis* Sibth. & Smith Fl. Graec. I, 63 (excl. syn. Desf.)

*Dactylis distichophylla* Brign. Fasc. Pl. Foroj. 16.

*Calothea littoralis* Spreng. Syst. Veg. I, 347.

*Description* :—Caespitose, densely intricate, creeping, stoloniferous, the sterile stolons long-prostrate; sheaths as long as the internodes; floriferous culms several, squamose-vaginate at the base (sheaths coriaceous), erecto-ascending; leaves canaliculate, short, lanceolate, acute, very often distichous-squarrose, hard, glaucous, smooth, mucronato-callose at the apex; ligule pilose.

Panicle terminal or axillary, on a very short peduncle, ovate-oblong, slightly elongate, dense; branches very short, disticho-glomerate. Spikelets glabrous, 9-12-flowered, oblanceolate or lanceolate, short; florets densely imbricate; glumes ovate, acute, concave, carinate, obscurely nerved on the margin; lower palea obsoletely 5-nerved, ovato-mucronate; upper palea bidenticulate.

*Locality* :—Sandy plain between Barriere Gate and Shaikh Othman (Defl.).

*Distribution* :—Spain, France, Italy, Greece, Asia Minor, Algeria, Tunis, Egypt, Arabia (not Sind).

## LVII.—GNETACEÆ.

Trees or shrubs; branches jointed at the nodes. Leaves opposite, large and green or minute and scale-like; stipules 0.

Flowers 1-sexual, monoecious or dioecious, in axillary or terminal spikes or cones. Male flowers: perianth valvately 2-lobed or spathaceous; stamens connate in a column of united filaments; anthers 2-8, globose, 1-3 celled, sessile or subsessile on the column. Female flowers: a naked erect ovule with 2-3 coats, of which one is produced into a styliform tube with a discoid mouth.

Seed dry or drupe-like; albumen copious or scanty; embryo straight; cotyledons appressed; radicle long, supericr.

*Genera* 3 ; *species* about 40.

*Distribution* :—In temperate and tropical regions.

### 1. *Ephedra* Linn.

Erect or subscandent rigid shrubs ; branches opposite or whorled, terete, striate, with membranous sheaths at the nodes, which often bear narrow leafy blades.

Flowers unisexual, usually dioecious. Male flowers in short bracteate spikelets which are whorled or in pairs. Perianth of 2 opposite compressed membranous sepals. Anthers 2-8, on a central column, 2-celled, opening by a short slit at the apex. Female flowers usually in pairs, sometimes 3 or solitary, each flower consisting of 1 ovule with a single integument prolonged into a styliform tube (tubillus) and enclosed in a bag, each female inflorescence supported by several pairs of decussate bracts.

Fruit in our species fleshy, consisting of several succulent bracts enclosing 1 or 2 seeds. Seeds usually oblong, plano-convex, testa dry.

*Species* about 30.

*Distribution* :—Dry regions of Europe, N. Africa, Asia, America.

1. *Ephedra foliata* Boiss. Fl. Orient. V (1881), 716 ; Stapf, Die Art. d. Gatt. *Ephedra* (1889) p. 49 ; Cooke Fl. Bomb. Pres. II, 665.

*Ephedra peduncularis* Boiss. Fl. Orient. V (1881), 717 ; Hook Fl. Brit. Ind. V, 641.

*Ephedra* Alte Brandis For. Fl. p. 501, t. 69 (not of C. A. Meyer).

*Description* :—A dioecious or monoecious climbing shrub reaching 15 feet long or more (rarely prostrate or hanging from walls) ; branches often fascicled, slender ; bark green or glaucescent, smooth, striate ; buds terminal, minute, shortly ovate or more or less elongate. Leaves 2, 3, or 4, shortly connate at the base,  $1-1\frac{1}{8}$  inch long by  $\frac{1}{2}\frac{1}{5}$  inch broad, linear-setaceous. Male flowers : spikelets ovate, obtuse, tetragonal, in pairs, or 3 together, or solitary, of various lengths, often with a peduncle  $1-1\frac{1}{2}$  inches long ; flowers 6-24 ; bracts rotund, obtuse, connate for  $\frac{1}{3}-\frac{1}{2}$  their length,  $\frac{1}{16}-\frac{1}{12}$  inch long and as broad as long ; perianth obovate, exceeding the bracts ; staminal column equalling the perianth or shortly exserted. Female flowers : floral gaulbuli in depauperate usually nodding cymes, ovate, on long peduncles or in short fascicles, with 3 pairs of bracts ; flowers usually in pairs, equalling the bracts ; integument at first oblong, obtusely trigonous ; tubillus

exserted, straight, short. Fruit globose,  $\frac{1}{4}$  inch in diameter, semitransparent, red or milky white, with 2 dark-coloured seeds.

*Flowers* :—May 1886 (Defl.), Dec. 1888 (Schweinf.).

*Fruits* :—Febr. 1851 (Thomson), April 1878 (Perry), May 1886 (Defl.).

*Locality* :—Ravines west of the Tower of Silence (Defl.) ; ravine on the northern side of the Shum Shum Range, trailing in thorny shrubs (Schweinf.) ; without locality (Hook., Birdw., Perry).

*Distribution* :—Syria, Turkestan, S. Persia, Afghanistan, Western Punjab, Sind.

*Note* :—The size of the leaves seems to vary a good deal. In Schweinfurth's specimens they measure  $\frac{1}{8}$  inch in length, whilst Deflers' plants, collected in the same locality, show leaves of almost  $\frac{4}{8}$  inch in length. The leaves of Hooker's specimens measure  $\frac{2}{8}$ - $\frac{5}{8}$  inch.

*Uses* :—It has been suggested that the 'soma' of ancient classical writers may have been the astringent stems of Ephedra employed in place of hops, and not as itself the source of the liquor of which so much has been written. (Watt. Dict. Econ. Prod. III, 247-51.)

## FUNGI.

*Podaxon arabicus* Pat. Bull. Soc. Mycol. (1887), p. 122, Saccardo Syll. Fung. IX, p. 268.

*Description* :—Peridio subgloboso-ovato, 4-5 cm. alto sicco brunneo-rufo, membranaceo, 1-2 mm. cr., apice parce adpresso-squamoso, deorsum usque ad dimidium altitudinis in 5-7 lacinias acutas divisio ; stipite basi incrassato, 12 cm. circ. alt., 1.5 cm subtus diam., apice attenuato, usque ad peridii apicem in columellam producto, durissimo, sublignoso, hinc inde scarioso-squamoso, longitudinaliter tenuissime striato-fibroso, flavo-aurantio maculis saturate rubris marmorato, intus floccoso-medulloso ; sporarum massa compacta, brunneo-rufa, cinnabarino-maculata ; sporis globulosis, rufis, laevibus, eguttatis.

*Locality* :—Shaik Othman (Defl.).

*Distribution* :—Ad planities sabulosas inter Shaik Othman et Lahej, prope Aden.

## LICHENES.

*Physcia vulcanica* Stnr. Denkschr. Wiener Akad. vol. 71 (1907) p. 94.

*Description* :—Thallus parvus, subrosulatus et lobatus, controversus irregulariter areolato-rimosus, ad 1.5 mm latus, v. nonnulli confluentes, omnino adpressus et fere planus, parcius sorediosus, supra cinerec v.

subglauco-albidus, madefactus paullo perlucens, infra pl. m. dilute sordide ochraceus, K H O adh. extus et intus lutescens.

Cortex superior subordinate cellulosus ad  $20\ \mu$  crassus. Cortex inferior indistinctus, rhizinae nullae. Lobi primarii ad 3-4 mm longi et ad 0.2 mm crassi, marginem versus delatati et cum ramulis ad 3-3.5 mm. lati, plani centro versus h. i. paullo convexuli, ter v. quater subdichotome ramosi, rami contigui et ad apicem dilatati et. pl. m. crenato-incisi. Soralia tenera, subrotunda et marginata vel elongata et confluentia in partibus adultioribus rariora adsunt; soredia alba. Apothecia desunt. Pycnides punctiformes (0.15 mm. lt.), paullo emergentes, nigrae, madef. fuscescentes. Fulera parmelioides minora, saepius pauci-articulata. Pycnoconidia bacillaria recta  $5.5-9\ \mu$  longa et ca.  $1\ \mu$  crassa, obtusa.

*Locality* :—On lava of Shum Shum Range (Simony).

**Physcia tribacia** Nyl. Fl. (1881), p. 537. Ach. Univ. (1810), p. 415 (sub Lecanora).

*Description* :—P. crusta imbricata albo-incana subtus subfibrillosa, lobis irregularibus difformibus eroso-crenulatis, apotheciis adpressis, disco plano pallido in ambitu demum crenato lobato, margine thallode elevato persistente.

*Locality* :—On lava of Shum Shum Range (Simony).

*Distribution* :—Ad truncos arborum et in saxis Helvetiae, Angliae.

**Ramalia farinacea** Ach. Univ. (1810) p. 606.

Parmelia farinacea Ach. Meth. Lich. 263.

Lichen farinaceus Linn. S. N.

Lichen rostratus femina Scop. Fl. Carn. 378.

*Description* :—R. thallo tereti-compresso glabro sublacunoso soredifero rigido ramoso albo subeinerascente, ramis lineari-attenuatis, apotheciis sparsis pedicellatis planis subimmarginatis albidis.

*Locality* :—On lava of Shum Shum Range (Simony).

*Distribution* :—Ad arborum truncos et ramos in Europa.

**Caloplaca (Amphiloma) lobulascens** Stnr. Denkschr. Wiener. Akad. vol. 71 (1907), p. 95.

*Description* :—Thallus irregulariter vel interrupte suborbicularis v. fere expansus, squamae parvae ut in Cal. lobulata formatae etiamque h. i. coralloideo-granulosae, sed siccae albescentes, pallide ochraceae v. pallide lutescentes, madef. distincte luteae et K H O adh. maculatim intus purpurascens. Apothecia parva ad 0.5 mm. lata v. saepius minora, primum concava et thallo marginata, deinde saepe paullo convexula,

marginē thallino demisso. Discus luteus, rarius pl. m. aurantiacus v. varie fuscescens. Paraphyses bene clavatae. Sporæ ut in Cal. lobulata sed crassiores 10-14  $\mu$  lg. et 6·5—8·5  $\mu$ . lt. Pycnides lutescentes tuberculiformes. Fulcra endobasidialia, crebre septata, ramosa. Pycnoconidia elliptica vel ovoidea, 1·8-2  $\mu$  longa et 0·5-1  $\mu$  lata.

*Locality* :—On lava of the Shum Shum Range (Simony).

**Roccella Montagnei** Bélanger Voy. Ind. Or. P. 3, p. 117 sec. Darbish. Monogr. Roccell. p. 24.

*Description*.—Thallus fruticulosus, basi substrato affixus, prothallus bene evolutus, latus 6 mm. crassus 2 mm., strato corticali instructus ex hyphis transversalibus, strato gonidiali et strato medullari laxiore in substratum penetrantibus; podetia erecta, ramosa, dichotome divisa aut plus minusve fissa, valde complanata, loriformia, membranacea, alta ad 30 mm, lata 1-6 mm, usque ad 5 cm., crass. 0·25-0·5 mm; virescentia, glauco-viridia; anastomosantia; stratum corticale ex hyphis formatum transversalibus; stratum gonidiale distinctum; stratum medullare ex hyphis formatum plus minusve longitudinalibus, laxè contextis, 2-5  $\mu$  crassis. Apothecia lateralia, orbicularia, superficialia aut saepius marginalia, basi constricta, 1 mm lat.; hypothecium fusco-nigrum 10--300  $\mu$  crass.; parathecium fusco nigrum vel fuscescens, 10  $\mu$  crass.; amphithecium gonidiis instructum; thecium 80  $\mu$  altum; asci 16  $\mu$  lati; sporæ octonæ, decolores, fusiformes, quadriloculares, longit. 40  $\mu$  latit. 4  $\mu$ ; paraphysæ ramosæ, thecii 1-1·8  $\mu$  lat., epithecii 2·5  $\mu$  lat.; epithecium fuscescens, parce pruinatum, laxè contextum, 40  $\mu$  alt. Spermogonia lateralia, simplicia, thallo immersa; excipulum 10-12  $\mu$  crass., discolor; ostiolum prominulum, fuscescens; sterigmata simplicia (?) 20  $\mu$  alt.

Soralia lateralia, orbicularia, marginalia aut superficialia, 0·5-1 mm lat.; soredia rotundata, 20-40  $\mu$  lat. (Ex. Darbish. l. c.).

*Locality* :—On lava of Shum Shum Range (Simony).

*Distribution* :—On trees, rarely on maritime rocks.

Africa (Senegambia, Congo Angola, Socotra, Zanzibar, Mozambique, Cape of Good Hope, etc.), India, Ceylon, Sumatra, Java, Philippines, China, Australia (Liverpool River).

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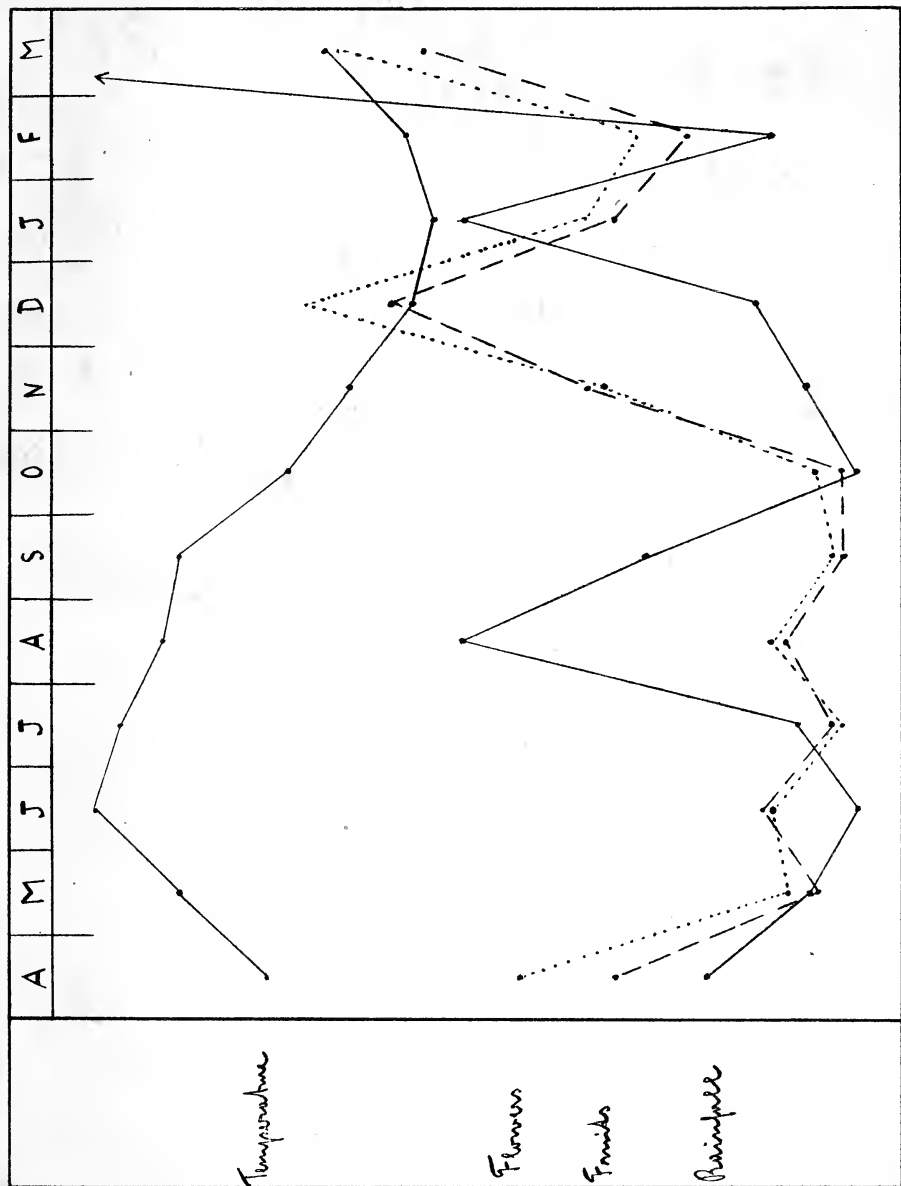
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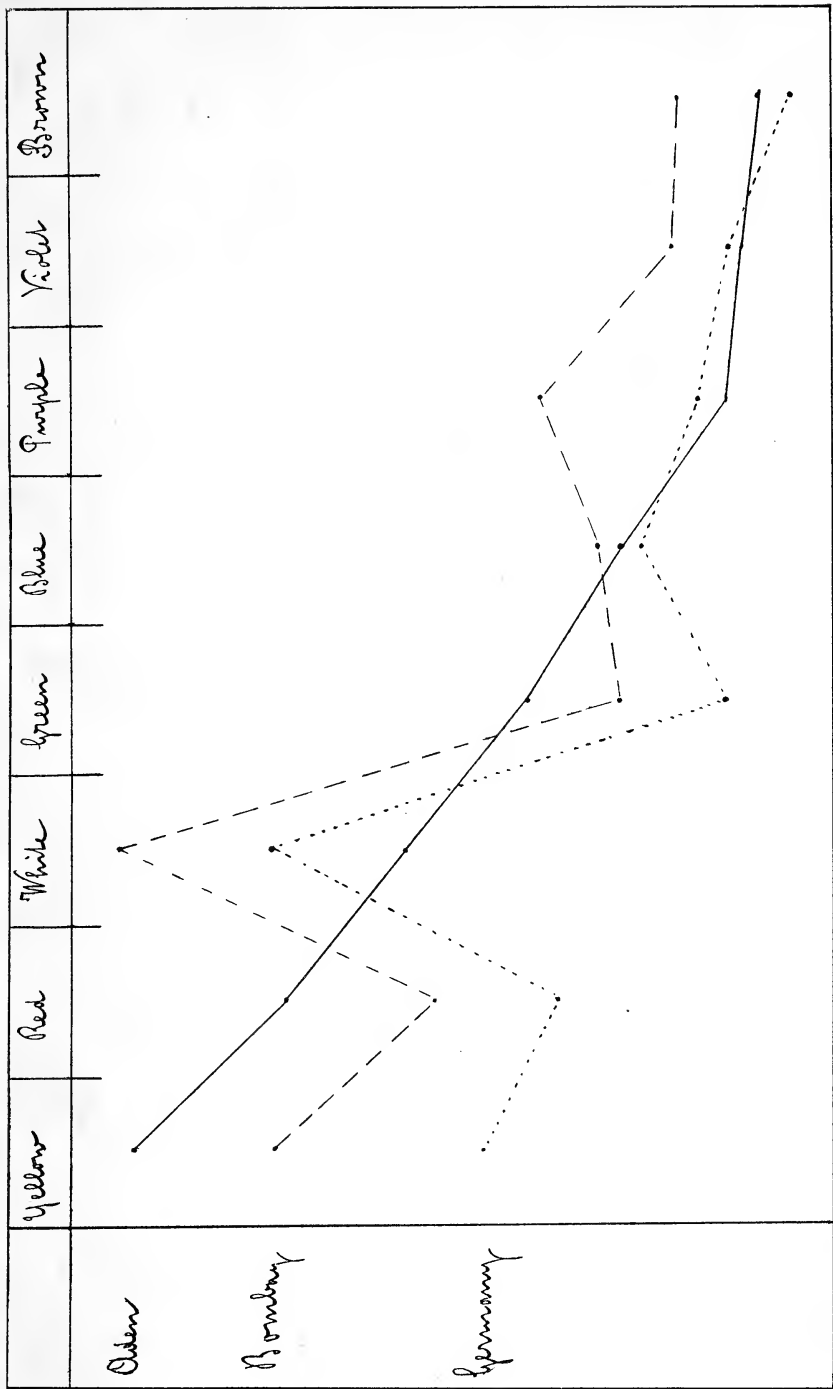
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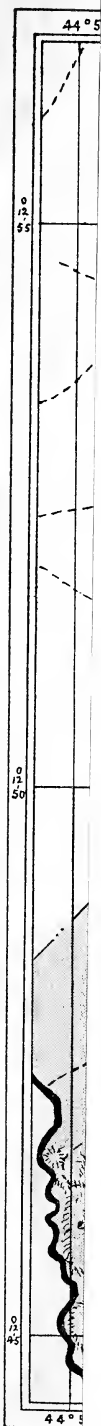
Relation of Flowering - and Fruiting Season to Temperature and Rainfall at Aden.





Relative Prevalence of the various colors of flowers as observed  
at Odor in the Bombay Presidency and Germany.

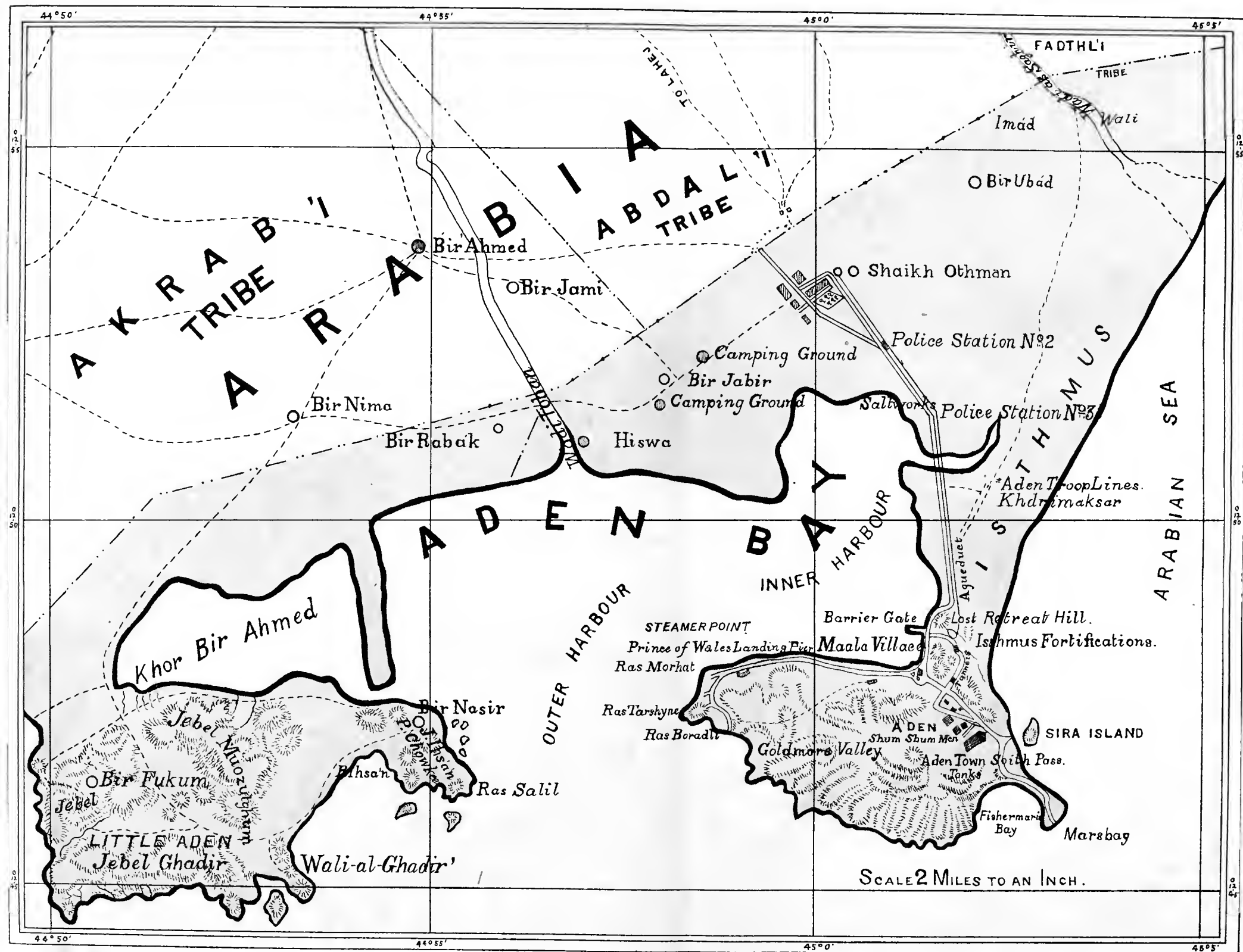




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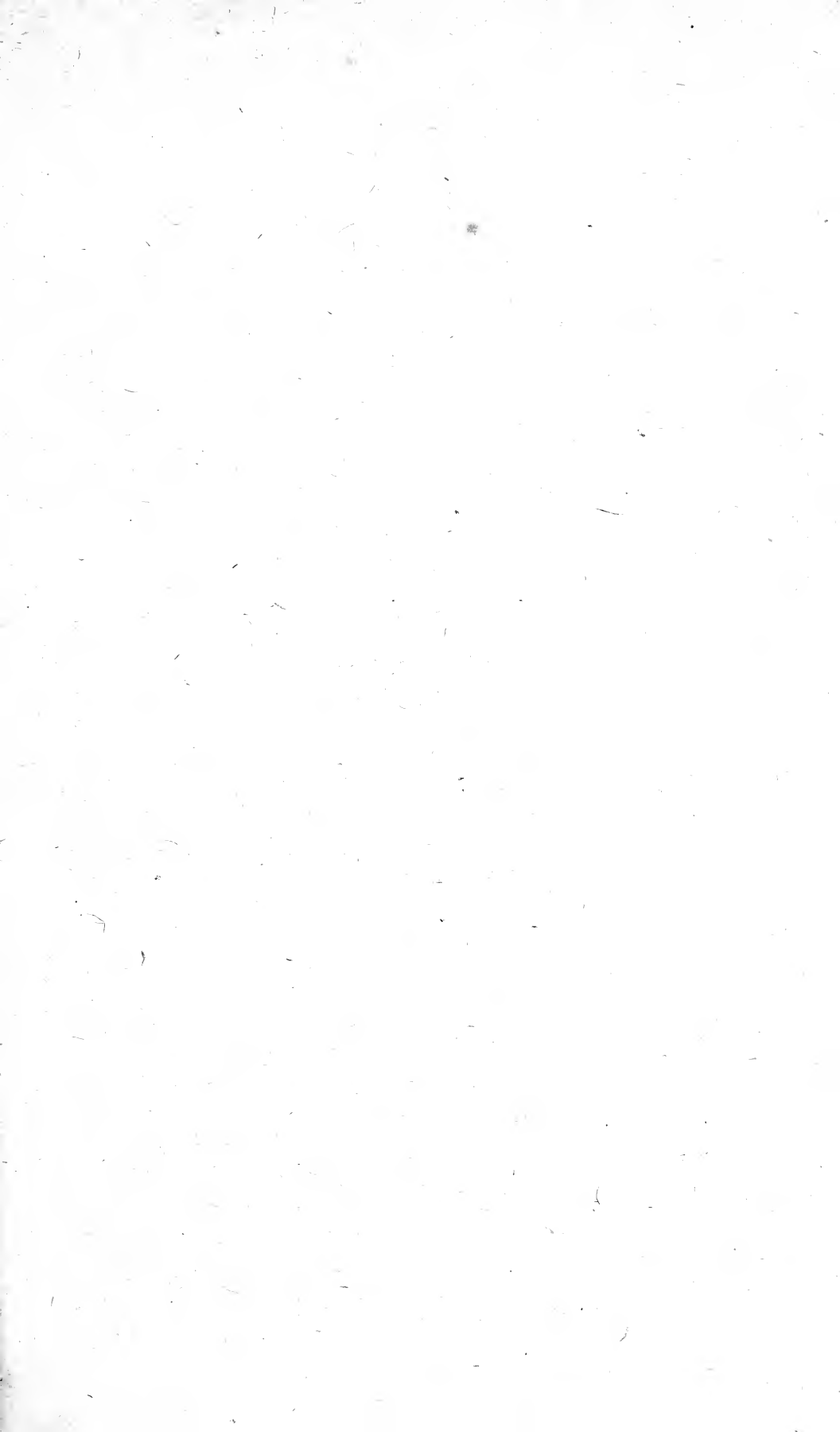
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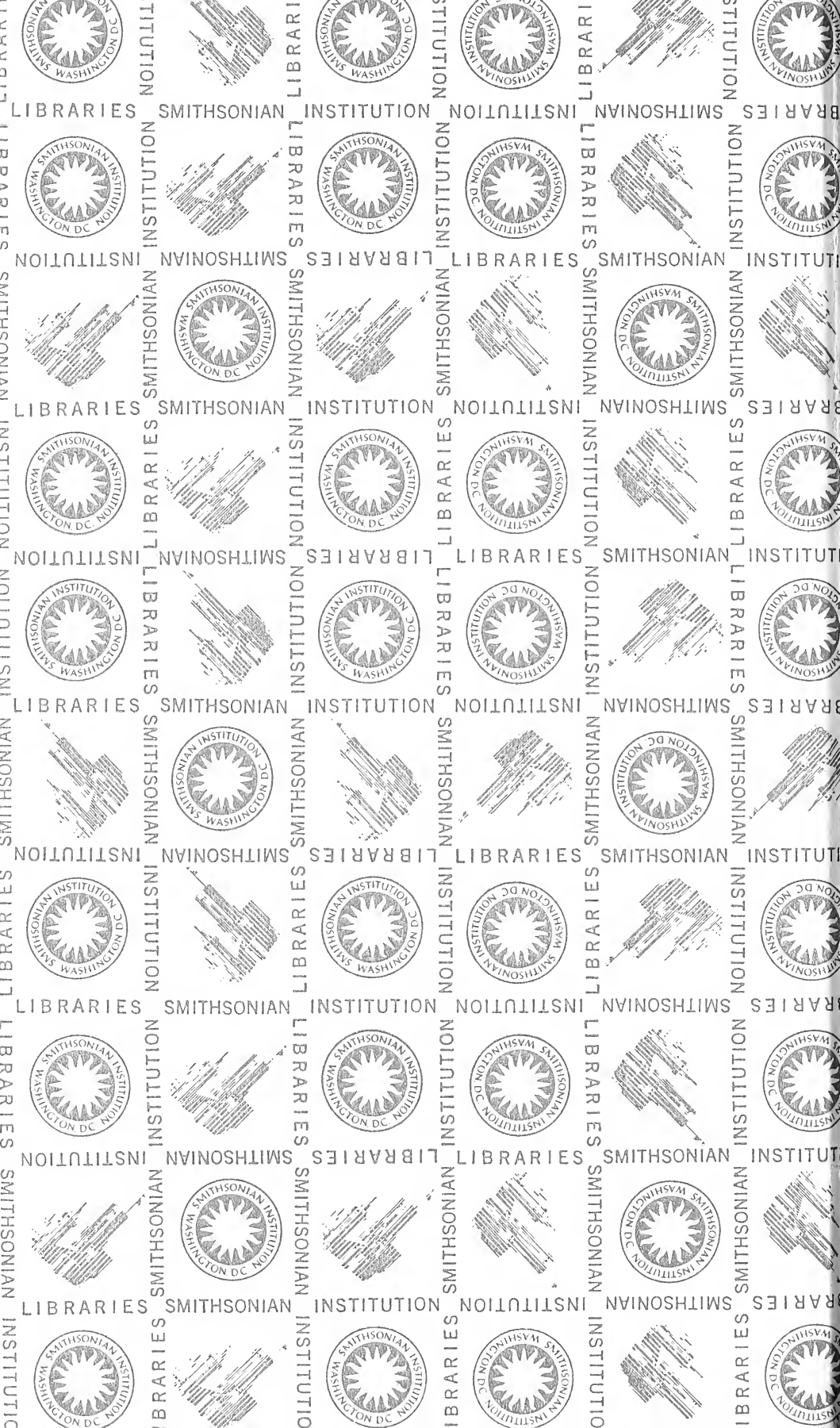


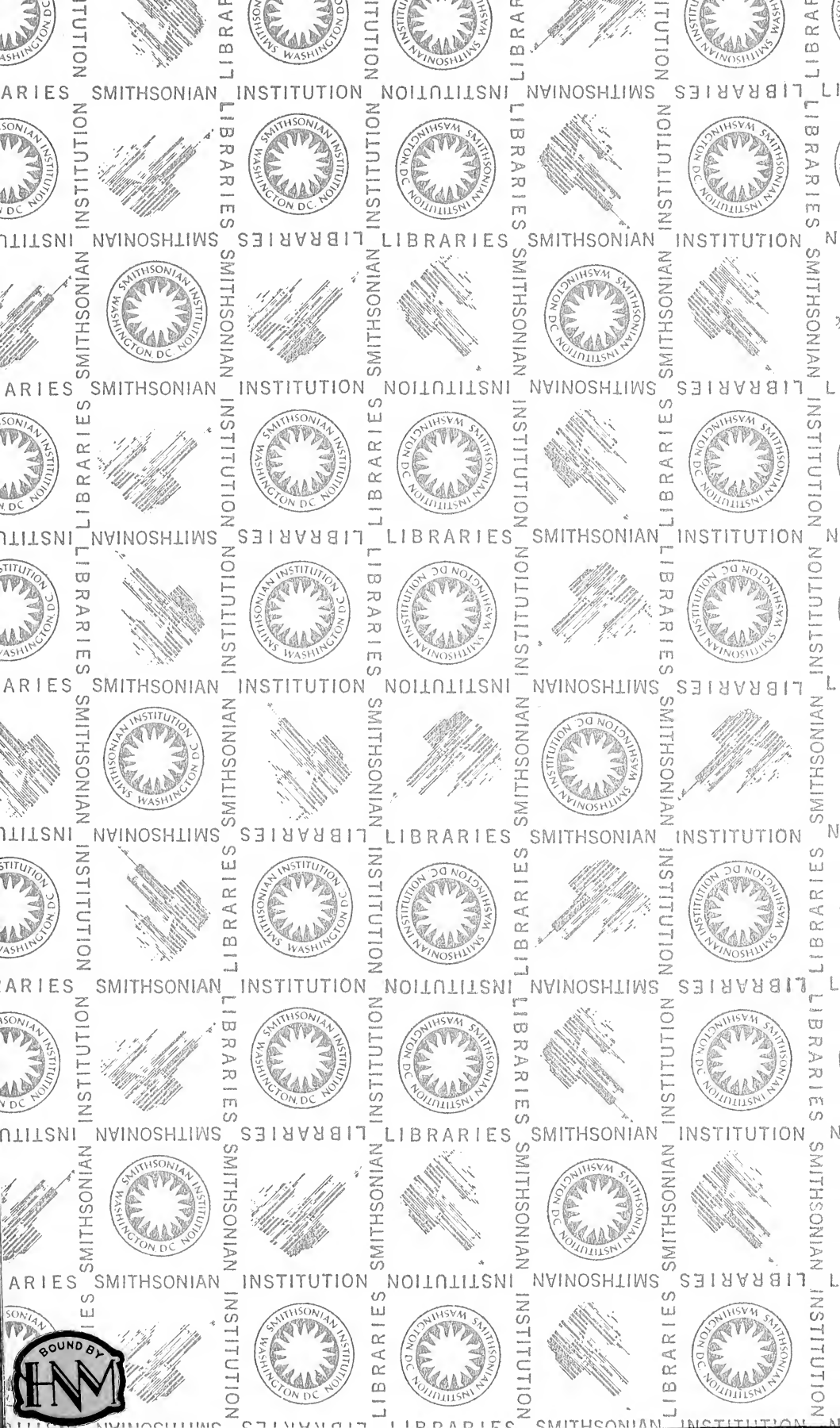












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